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ABSTRACT

Each volume of this three-volume set is divided into two major sections. The first section presents the narrative report of a study designed to assist Michigan vocational agriculture teachers in implementing local competency-based vocational agriculture programs by (1) developing student performance objectives; (2) identifying up-to-date reference materials for teaching agricultural production, agricultural mechanics, and ornamental horticulture; and (3) developing a delivery system and materials to provide competency-based education training. The second section, which comprises the bulk of the document, contains three appendixes: student performance objectives, selected references for teachers, and a key to finding the sources. This second volume presents the identified objectives and reference materials for teaching agricultural mechanics. The other two volumes contain the objectives and reference materials for teaching agricultural production (CE 016 907) and ornamental horticulture (CE 016 909). (BM)

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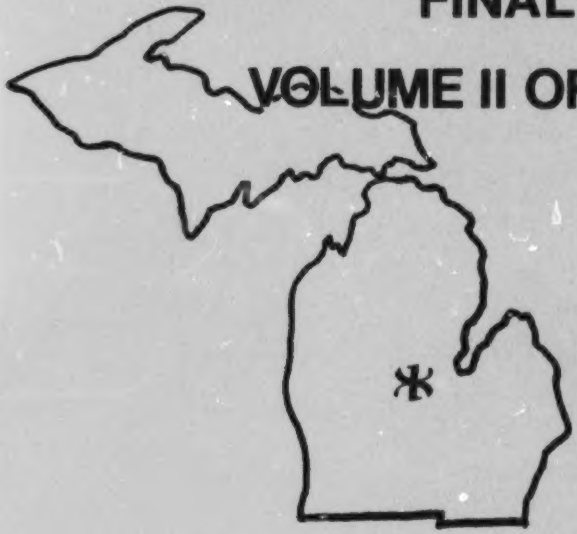
STUDENT PERFORMANCE OBJECTIVES AND SELECTED REFERENCES FOR TEACHING AGRICULTURAL MECHANICS

FINAL REPORT

VOLUME II OF III VOLUMES



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EDUCATION INSTITUTE

OE016908

STUDENT PERFORMANCE OBJECTIVES AND SELECTED REFERENCES FOR TEACHING AGRICULTURAL MECHANICS

Volume II of III Volumes

Final Report

Eddie A. Moore, Project Director

With the Assistance of:

Raymond J. Clark, Graduate Assistant   Richard M. Nysteun, Graduate Assistant

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Agriculture and Natural Resources Education Institute
Michigan State University
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June, 1976

This project was funded by the Michigan Department of Education, Vocational-Technical Education Service, under the project title "The Development of a Delivery System and Materials to Provide Competency-Based Education Training for Michigan Vocational Agriculture Teachers".

ACKNOWLEDGEMENTS

Since the inception of the project, many individuals and agencies have made significant contributions to the development of materials included in the final report. The project director wishes to express his appreciation to those who have contributed to the completion of the project.

First, sincere thanks is extended to the project staff for their conscientious efforts throughout the study. Namely, Messrs. Raymond J. Clark and Richard Nysteun, Graduate Assistants, Agriculture and Natural Resources Education Institute, Dr. Raymond M. Clark, Project Consultant, and Mrs. Sandi Bauer, Project Secretary.

Second, gratitude is expressed to Dr. Carroll H. Wamhoff, Director, Agriculture and Natural Resources Education Institute, and his staff, for assistance in the administration of the project.

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Finally, gratitude is expressed to the many public and private agencies whose cooperative support made this report possible.

Dr. Eddie A. Moore
Project Director

ABSTRACT

Title of Project:	Development of a Delivery System and Materials to Provide Competency-Based Education Training for Michigan Vocational Agriculture Teachers
Project Staff:	Eddie A. Moore, Assistant Professor and Project Director Raymond J. Clark, Graduate Assistant Richard M. Nysteun, Graduate Assistant Raymond M. Clark, Project Consultant Sandi L. Bauer, Project Secretary

Beginning and Ending Dates: January 1, 1976 through June 30, 1976

Purpose: To assist Michigan Vocational Agriculture Teachers (those employed and those in pre-service training) in acquiring the knowledge, information, and skills needed to implement local competency-based vocational agriculture programs.

Statement of Objectives: (1) To prepare a summary publication of a study conducted by Dr. William L. Thuemmel and other researchers which focused on the annual agricultural employment needs in Michigan for 1974 through 1979 and the characteristics of vocational agriculture programs in the state; (2) To develop student performance objectives and identify up-to-date reference materials for teaching Agricultural Production, Agricultural Mechanics, and Ornamental Horticulture; and (3) To develop a delivery system and materials to provide competency-based education training for Michigan teachers of vocational agriculture.

Description of Activities: A summary report of the study of Dr. Thuemmel and other researchers which focused on the agricultural employment needs for a five-year period and the characteristics of Michigan vocational agriculture programs was prepared. Student performance objectives were developed and reference materials (eight-hundred or more publications were reviewed and evaluated) identified for three vocational agriculture instructional areas. A delivery system and materials were developed to provide competency-based education training for Michigan vocational agriculture teachers.

Contribution to Education: The summary publication is available for use by school administrators, Career Education Planning District coordinators, teachers of vocational agriculture, state department personnel, teacher edcuators and other individuals interested in long-range planning of vocational agriculture programs. Student performance objectives and selected references are available for improving the teacher/student learning process in three instructional program areas. Strategies for making Michigan vocational agriculture programs competency-based are available for implementation.

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THE NARRATIVE REPORT

Problem

In recent years, the Michigan Department of Education, Vocational-Technical Education Service has actively attempted to improve the quality of vocational education programs in Michigan. One approach used by the Vocational-Technical Education Service to improve the quality of vocational programs was the writing of student performance objectives. In the early 1970s, selected teachers representing service areas in the state were used in writing minimum state performance objectives. Many local vocational personnel adopted the state minimum performance objectives as a basis for operating accountable programs. Some local vocational educators elected to write their own student performance objectives. It has been stated by some local and state educators that the efforts spent in writing performance objectives in the early 1970s did in fact improve the quality of vocational education instruction in Michigan.

Because of rapid changes in agriculture and the need to prepare better graduates for filling various agricultural positions, the quality of vocational agriculture programs in Michigan were assessed during the 1974-75 academic year by Dr. William L. Thuemmel and other researchers. One objective of the study titled "Agribusiness and Natural Resources Education in Michigan: Manpower Needs, Competencies Needed, School Program Characteristics" was to "determine the competencies needed for entrance in agriculturally related jobs". A task analysis process was used to identify and validate competencies needed by beginning workers for entry into a cluster of agricultural occupations for the following United States Office of Education (USOE) program areas: (1) Agricultural Production; (2) Agricultural Mechanics; and (3) Ornamental Horticulture. While examining some of the preliminary data reported by Dr. Thuemmel and others, it was deemed appropriate that a delivery system was needed to assist Michigan vocational agriculture teachers in the implementation of Competency-Based Instruction. During the latter months of 1975, representatives from the Michigan Department of Education, Vocational-Technical Service, faculty from the College of Agriculture and Natural Resources and the College of Education at Michigan State University held a series of meetings and agreed on a strategy for making vocational agriculture programs in Michigan Competency-Based. A proposal for carrying out this strategy was funded and the project begun in January, 1976.

Purpose and Objectives

The purpose of the project was to assist Michigan vocational agriculture teachers (those employed and those in pre-service training) in acquiring the knowledge, information, and skills needed to implement local competency-based vocational agriculture programs.

The primary objectives of the project were:

1. To prepare a summary report of a study conducted by Thuemmel and other researchers which focused on:
    a. Agricultural manpower needs (primarily for Michigan high school vocational agriculture graduates) for 1974 through 1979.
    b. Competencies needed by Michigan high school vocational agriculture graduates in order to enter various agricultural occupations.
    c. Congruencies and differences in existing vocational agriculture programs.

2. To develop student performance objectives based on the Thuemmel study and studies completed by other agencies, and identify up-to-date reference materials for teaching the following United States Office of Education vocational agriculture program areas:
   a. Agricultural Production
   b. Agricultural Mechanics
   c. Ornamental Horticulture
3. To develop a delivery system and materials to provide competency-based education training for Michigan vocational agriculture teachers.

Description of Activities

The project consisted of three activities: (1) Preparation of a summary report which focused on the manpower needs for Michigan high school vocational agriculture graduates and the quality of programs in the state; (2) Preparation of student performance objectives and the identification of reference materials for three vocational agriculture program areas; and (3) The development of a delivery system and materials to provide Competency-Based Education training for Michigan vocational agriculture teachers. Further discussion of each activity follows.

Summary Report.--A comprehensive research project titled "Agribusiness and Natural Resources in Michigan: Manpower Needs, Competencies Needed, and School Program Characteristics", was conducted by Thuemmel and other researchers during the 1974-75 academic year. Because of the terminology used in addition to being a lengthy final report (nearly 400 pages), a summary document which consist of approximately 40 pages has been prepared. In general, the summary report consist of the following: (1) Purpose and Objectives;

(2) Statements regarding the need for the study; (3) Methodology used; (4) Major findings; and (5) Recommendations. Persons interested in receiving a copy of the summary report should write to: Agriculture and Natural Resources Education Institute, 410 Agriculture Hall, Michigan State University, East Lansing, Michigan 48824.

Student Performance Objectives and Reference Materials.--In developing and compiling student performance objectives for the three instructional program areas (Objective 2), the project staff primarily used the task analysis results from the study conducted in 1974-75 by Dr. Thuemmel and other researchers at Michigan State University. Other sources used in developing student performance objectives for this project were as follows:

1. Amberson, Max L., Bishop, Douglas D., and Agocs, Barbara. Competency Commonalities and Accompanying Job Titles Derived from the Six Montana Agricultural Manpower Studies. Bozeman, Montana: Department of Agricultural and Industrial Education, Montana State University, 1975.

2. Bristol, Benton K. Volume III--Program Planning Guide in Agricultural Mechanics. Carbondale, Illinois: Southern Illinois University, 1975.

3. Moore, Eddie A., et al. A Study of Job Demands and Curriculum Development in Agricultural Training Related to the Muskegon County Wastewater Management System. Vol. III: Student Terminal Performance Objectives and Instructional Modules. Muskegon, Michigan: Vocational Education Department, Muskegon Area Intermediate School District, 1976. A research and program development project conducted pursuant to a contract from the U.S. Office of Education.

4. Rich, William and Wood, Eugene. Volume I--Program Planning Guide in Agricultural Production. Carbondale, Illinois: Southern Illinois University, 1975.

5. Ross, Roger T. and Stitt, Thomas R. Volume V--Program Planning Guide in Ornamental Horticulture. Carbondale, Illinois: Southern Illinois University, 1975.

6. U.S. Department of Health, Education and Welfare, Office of Education. Career Preparation in Agricultural Production--A Curriculum Guide for High School Vocational Agriculture. Columbus, Ohio: Ohio Agricultural Education Curriculum Materials Service, The Ohio State University, 1974.

7. U.S. Department of Health, Education and Welfare, Office of Education. Career Preparation in Agricultural Equipment and Mechanics--A Curriculum Guide for High School Vocational Agriculture, 1974.

8. U.S. Department of Health, Education and Welfare, Office of Education. Career Preparation in Ornamental Horticulture--A Curriculum Guide for High School Vocational Agriculture, 1974.

9. Warmbrod, J. Robert. Criterion-Referenced Instruments for Assessment of Specialized Vocational Agriculture Programs--Agribusiness Supplies and Services, Agricultural Mechanics, Horticulture, and Farm Management. Columbus, Ohio: Department of Agricultural Education, The Ohio State University, 1974.

The first step used in developing student performance objectives was the identification of module titles. Each module title consisted of one or more student performance objective. Student performance objectives written by the staff outlined specifically: (1) The conditions under which the student will perform; (2) What the student will be able to do after instruction; and (3) How well the student will perform. The student performance objectives were reviewed by teachers of vocational agriculture or other agricultural experts.

Approximately eight-hundred publications were reviewed and evaluated during the study. Selected references were identified for each module title to assist teachers in teaching the student performance objectives. Each reference was identified according to the type of material (i.e. bulletin, pamphlet, filmstrip, etc.) and an AGDEX number(s). AGDEX numbers were listed to assist teachers in filing reference materials when they arrived at the local school. In this publication you will find student performance objectives and references for Agricultural Mechanics. Persons interested in student performance objectives and reference materials for the instructional areas of Agricultural Production and Ornamental Horticulture should write to: Agriculture and Natural Resources Education Institute, 410 Agriculture Hall, Michigan State University, East Lansing, Michigan 48824.

A Delivery System and Materials to Provide Competency-Based Education Training for Michigan Vocational Agriculture Teachers.--Objective 3 of the project stated that the staff would develop a delivery system and materials to provide Competency-Based Education Training for Michigan Vocational Agriculture Teachers. To follow are materials which have been developed:

1. Competency-Based Education Information. A document titled "Utilizing Michigan's Vocational Education Competency-Based Education Approach in Conducting Effective Vocational Agriculture Programs" has been developed. This information has been written to assist Michigan vocational agriculture teachers (those employed and those in pre-service training) in acquiring the knowledge, information, and skills needed to implement local competency-based vocational agriculture programs.
2. Manual for Determining Agricultural Employment Needs in One or More Career Education Planning Districts (CEPDs). The need to determine local employment needs is probably more urgent today than ever before. A manual has been prepared to assist vocational agriculture teachers, administrators, advisory committee members, and other individuals in determining agricultural employment needs in one or more CEPDs.
3. An Instructional Strategy for Updating What is Being Taught and to Improve Instructional Process. With rapid technological changes in the agricultural industry, teachers of vocational agriculture must update the technical content and use a variety of teaching techniques that will enhance the learning of students. A delivery system for updating the technical content and for improving the instructional process has been refined and is available for use by teachers of vocational agriculture and other educators.

Individuals interested in more information briefly mentioned under project objective number 3 should write to: Eddie A. Moore, Agriculture and Natural Resources Education Institute, 410 Agriculture Hall, Michigan State University, East Lansing, Michigan 48824.

Recommendations

1. Future curriculum development activities should evolve around the core concept with the development of instructional modules based on written student performance objectives for three instructional program areas (i.e. Agricultural Production, Agricultural Mechanics, and Ornamental Horticulture). These modules should include as a minimum the following sections:
    a. Module Concept
    b. One or More Student Performance Objective
    c. Instructional Content Areas
    d. Supporting References
    e. Instructional Resources
    f. Student Learning Activities
    g. Objective Referenced Tests
2. A delivery system to provide Competency-Based Education Training for Michigan vocational agriculture teachers should be pilot tested and implemented starting September, 1976.

Directions for Using the Appendices

Shown in Appendix A are student performance objectives for two specialty areas within the Agricultural Mechanics area. These are consistent with and coded as defined in the Standard Terminology for Curriculum and Instruction in Local and State School Systems. The overall area of Agricultural Mechanics is given the designation 01.03 00. The specialty areas have the following designations:

Agricultural Power and Machinery	01.03 01
Agricultural Mechanics Skills	01.03 05

In Appendix B, you will note that references have been identified for module titles in each specialty area. Appendix C indicates where references might be ordered. The sample format and information on pages 8 to 12 explains how the Appendices should be used.

Explanation of the Format.--As shown by Circle 1, the USOE vocational agriculture program area is Ornamental Horticulture. The specialty area shown in parenthesis is "Landscape Establishment and Maintenance". Circle 2 depicts the USOE code number for this specialty area. Shown with Circle 3 is the module title which should be covered by the instructor. As shown by Circle 4, student performance objectives for this module title were written in measurable terms. After reviewing the performance objectives, the teacher is given information relative to where references are listed in the document (see Circle 5). By going directly to the page specified, the teacher is able to see the type of up-to-date references which are available (see Circle 6). In order to assist vocational agriculture teachers in the filing of agricultural publications a system (AGDEX) for classifying, indexing, and filing has been developed. Many vocational agriculture teachers in the state are presently using the AGDEX system for filing agricultural publications. New teachers are encouraged to use this unique filing system. Circle 7 shows that each reference has a set of one or more AGDEX numbers. In observing reference number "6" on page 11, you will note that there is a set of three numbers (275). This set of numbers represent a broad area (Ornamental and Shade Trees) in the AGDEX filing system. Reference number "1" illustrates two sets (275/22) of numbers. The first set of numbers (275) represent the broad area and the second set of numbers (22) represent a sub-topic area under the broad area. Reference number "3" has two sets of three digit numbers (641/550). In essence, if enough copies of this reference (reference number three) are available, the teacher could file this document under two broad areas.

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VOCATIONAL AGRICULTURE RESEARCH PROJECT PERFORMANCE OBJECTIVES

① **Program Area:** Ornamental Horticulture (Landscape Establishment and Maintenance)

② USOE Code Number: 01.05 04

MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
③ PLANTING LANDSCAPE PLANTS AND TREES ⑤ References are on page 4.	1. Given a landscape plan, various types of plants which are bareroot, balled and burlapped, plus the necessary tools for transplanting,	the student will transplant various types of plants,	according to recommendations of the Cooperative Extension Service and/or teacher of vocational agriculture so that the plants are able to grow at their maximum.
④	2. Given trees needing protection from winter winds and temperatures and provided with wrapping material, string, wire, and stakes,	the student will properly wrap and stake the trees,	so that the trees are anchored in an upright position and the soil remains firm to prevent drying of the roots.
	3. Provided with plants and trees, a choice of mulching material and sufficient hand tools,	the student will apply a mulch to the plants and trees,	so well that the weeds are controlled, the moisture maintained and the appearance enhanced.

MODULE TITLE	⑥ REFERENCES	TYPE OF MATERIALS	⑦ AGDEX NUMBERS
PLANTING LANDSCAPE PLANTS AND TREES	1. Koelling, Melvin R., Extension Bulletin E-771--Tree Planting in Michigan. East Lansing, Michigan: Cooperative Extension Service, Michigan State University, 1973. (MI/3)	Bulletin	275/22
	2. Transplanting Shade Trees--VAS 5002. Urbana, Illinois: Vocational Agriculture Service, University of Illinois. (IL/2)	Pamphlet	275/22
	3. Mulches. Brooklyn, New York: Brooklyn Botanic Garden. (NY/3)	Pamphlet	641/550
	4. Brooks, William M., Utzinger, J.D., and Tayama, Harry K., Extension Bulletin 526--Mulches for the Home Grounds. Columbus, Ohio: Cooperative Extension Service, The Ohio State University. (OH/3)	Bulletin	641/550
	5. Tree and Shrub Forms--Their Landscape Use. Brooklyn, New York: Brooklyn Botanic Garden. (NY/3)	Pamphlet	272/17
	6. Baumgardt, John P., How to Care for Shade and Ornamental Trees. Kansas City, Missouri: Intertec Publishing Corporation, 1974. (MN/1)	Book	275
	7. USDA Home and Garden Bulletin 192--Transplanting Ornamental Trees and Shrubs. Washington, D.C.: Superintendent Of Documents for the U.S. Government Printing Office. (DC/1) ⑧	Bulletin	275/22
	8. Williams. L. and Herner, R.C., Using Mulches Around the Home (HM-9). East Lansing, Michigan: Horticulture Department, Michigan State University, 1974.	Bulletin	641/550
	9. Planting Ornamental Trees and Shrubs. Lafayette, Indiana: Audio-Visual Productions of Purdue University.	Slide Set	275/22

SAMPLE

KEY TO SOURCES

CODE	STATE	SOURCE AND ADDRESS
⑨ DC/1	District of Columbia	Superintendent of Documents U.S. Government Printing Office Washington, D.C. 20402
IL/2	Illinois	Vocational Agriculture Service 434 Mumford Hall University of Illinois Urbana, Illinois 61801
MI/1	Michigan	Agriculture and Natural Resources Education Institute 410 Agriculture Hall Michigan State University East Lansing, Michigan 48824
MI/3	Michigan	MSU Bulletin Office P.O. Box 231 East Lansing, Michigan 48824
MN/1	Minnesota	Hobar Publication 1305 Tiller Lane St. Paul, Minnesota 55112
NY/3	New York	Brookyln Botanic Garden 1000 Washington Avenue Brooklyn, New York 11225
OH/3	Ohio	Extension Bulletin Office The Ohio State University Columbus, Ohio 43210

APPENDIX A

Student Performance Objectives for Teaching Agricultural Mechanics

AGRICULTURE AND NATURAL RESOURCES EDUCATION INSTITUTE

VOCATIONAL AGRICULTURE RESEARCH PROJECT PERFORMANCE OBJECTIVES

Program Area: Agricultural Mechanics

USOE Code Number: 01.03 05

MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
SELECTING, USING AND CARING FOR TOOLS AND EQUIPMENT IN AGRICULTURAL EQUIPMENT MECHANIC SHOPS	1. Given various types of tool-fittings, and cold-metal tools used in repairing agricultural equipment,	the student will correctly identify the tools and demonstrate their uses,	with 95% of the tools identified in accordance with a tool catalog--demonstrated in accordance with previously established criteria of the instructor or a designated person.
References are on page 62	2. Given various types of machinery maintenance tools used in repairing and servicing agricultural equipment,	the student will correctly identify the tools and demonstrate their uses,	with 95% of the tools identified in accordance with a tool catalog--demonstrated in accordance with previously established criteria of the instructor or a designated person.
	3. Given various types of shop tools and equipment used in repairing and servicing agricultural equipment to be cared for and stored,	the students will care for and store the tools and equipment,	so that the tools and equipment will operate properly when used and they are stored according to previously established standards of the instructor or a person he/she designates.

AGRICULTURE AND NATURAL RESOURCES EDUCATION INSTITUTE

VOCATIONAL AGRICULTURE RESEARCH PROJECT PERFORMANCE OBJECTIVES

Program Area: Agricultural Mechanics

USOE Code Number: 01.03 05

MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
USING SAFETY AND SANITATION PRACTICES IN AGRICULTURAL EQUIPMENT MECHANIC SHOPS	1. When working in the school agricultural mechanics facility or on the job,	the student will exhibit and follow appropriate personal safety precautions such as: a. Personal dress b. Cleanliness c. Work habits,	as previously established by the instructor or employer.
References are on page 62	2. When asked to use various cleaning agents,	the student will follow and demonstrate proper safety precautions in using such agents,	according to procedures previously established by the instructor or as detailed on the container of the cleaning agent,
	3. Given access to a fork lift and objects to be relocated,	the student will follow and demonstrate proper methods of lifting and relocating objects,	according to procedures in fork lift operator's manual, without damaging any objects or the fork lift, and to the previously established standards of the instructor or the employer.
	4. Given access to a fire extinguisher and the task of putting out a fire in a simulation exercise prepared by the instructor.	the student will demonstrate the proper use of the fire extinguisher in putting out the fire,	so well that the fire is completely out, there is no bodily injury or damage to the extinguisher, and is performed to the previously established standards of the instructor.
	5. When working in the Agricultural Mechanic Shop,	the student will demonstrate ways in which fires are prevented or controlled with fire extinguishers,	to the previously established standards of the instructor.

AGRICULTURE AND NATURAL RESOURCES EDUCATION INSTITUTE

VOCATIONAL AGRICULTURE RESEARCH PROJECT PERFORMANCE OBJECTIVES

Program Area: Agricultural Mechanics

USOE Code Number: 01.03 05

MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
USING SAFETY PRACTICES IN OPERATING FARM MACHINERY References are on page 63	1. Given information regarding the safe operation of farm tractors, self-propelled combines, farm trucks, and other types of power driven farm equipment,	the student will: a. demonstrate and explain why one should be physically capable of operating farm equipment b. demonstrate and explain why one should be physiologically capable of operating farm equipment c. demonstrate and explain why one should be psychologically capable of operating farm equipment d. explain safety precautions necessary for the safe operation of farm equipment e. identify and explain various safety driving symbols f. demonstrate the proper use of hand signals as published by the American Society of Agricultural Engineers (ASAE),	so that the student is proficient in operating the equipment in a safe and efficient manner, and to the satisfaction of the instructor or a designated person.

AGRICULTURE AND NATURAL RESOURCES EDUCATION INSTITUTE

VOCATIONAL AGRICULTURE RESEARCH PROJECT PERFORMANCE OBJECTIVES

Program Area: Agricultural Mechanics

USOE Code Number: 01.03 05

MODULE TITLE	CONDITICNS	PERFORMANCE	CRITERIA
USING SAFETY PRACTICES IN OPERATING FARM MACHINERY	2. Given access to various types of farm machinery,	the student will perform the following tasks: a. identify and explain the functions of the controls, instruments, and other parts on farm machinery b. check fuel, oil, battery, and radiator if applicable c. start the engine d. start the farm machinery movement forward e. operate the farm machinery while in forward motion f. stop the forward movement of the farm machinery g. start, operate, and stop the movement of the farm machinery while backing up,	in a safe and efficient manner, and to the satisfaction of the instructor or a designated person.

AGRICULTURE AND NATURAL RESOURCES EDUCATION INSTITUTE
VOCATIONAL AGRICULTURE RESEARCH PROJECT PERFORMANCE OBJECTIVES

Program Area: Agricultural Mechanics　**USOE Code Number:** 01.03 01

MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
TROUBLESHOOTING THE ENGINES OF FARM TRACTORS References are on page 65	1. Given a farm tractor with defects in the engine, and access to tools and equipment,	the student will: a. Inspect the engine for defects b. Diagnose the problem c. Correct and adjust for satisfactory operation,	according to procedures and directions in service manual and to the previously established standards of the instructor.

AGRICULTURE AND NATURAL RESOURCES EDUCATION INSTITUTE

VOCATIONAL AGRICULTURE RESEARCH PROJECT PERFORMANCE OBJECTIVES

Program Area: Agricultural Mechanics

USOE Code Number: 01.03 05

MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
OPERATING OXY-ACETYLENE WELDING EQUIPMENT	1. Provided the appropriate oxy-acetylene welding equipment and pieces of steel or cast iron of various thicknesses,	the student will cut steel or cast iron,	well enough that the pieces fit intended purposes as determined by the instructor.
References are on page 66	2. Given various types of metals to be welded and the appropriate welding equipment,	the student will perform butt and fillet welds in various positions that when the following welding processes are completed a. Welding with steel rods b. Bronze welding c. Welding cast iron d. Hardsurfacing e. Fusion welding without a rod,	the metals welded will be of sufficient strength for the required operating conditions determined by the instructor.
	3. Given access to gas welding equipment, accessories and various types of metals to be welded or cut,	the student will apply safety practices while performing various types of welds or cuttings,	which will prevent injury to the body, other workers or damage to the equipment as determined by the instructor.

AGRICULTURE AND NATURAL RESOURCES EDUCATION INSTITUTE

VOCATIONAL AGRICULTURE RESEARCH PROJECT PERFORMANCE OBJECTIVES

Program Area: Agricultural Mechanics

USOE Code Number: 01.03 05

MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
OPERATING ARC WELDING EQUIPMENT References are on page 66	1. Given a specified number of metals found in agricultural equipment,	the student will identify	95% of the metals by their common names.
	2. Given a task of welding two pieces of metal together and the appropriate arc welding equipment,	the student will perform the following tasks to produce a weld: a. Prepare the metal for welding b. Select the appropriate electrode c. Select and adjust the proper current setting d. Strike the arc e. Maintain the proper arc length f. Maintain the proper speed of travel g. Run a bead,	of sufficient strength for the required operating conditions as previously established and satisfaction of the instructor or a person he/she designates.
	3. Given a metal to be welded and the appropriate welding equipment,	the student will follow safe operating procedures,	to prevent injury to himself/herself, other workers or damage to the equipment in accordance with previously established safety standards.
	4. Given metals to be welded and the appropriate welding equipment,	the student will prepare the metal and perform butt and fillet welds in the following positions:	of sufficient strength for the required operating conditions and in accordance with previously established standards

AGRICULTURE AND NATURAL RESOURCES EDUCATION INSTITUTE
VOCATIONAL AGRICULTURE RESEARCH PROJECT PERFORMANCE OBJECTIVES

Program Area: Agricultural Mechanics **USOE Code Number:** 01.03 05

MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
OPERATING ARC WELDING EQUIPMENT		a. Flat b. Horizontal c. Vertical d. Overhead,	of the instructor or a person he/she designates.
	5. Given specified operations to perform with the welder,	the student will prepare the metal and perform the following operations: a. Weld cast iron b. Cut and groove c. Hardsurface d. Use the carbon torch,	in accordance with previously established standards of the instructor or a person he/she designates.

AGRICULTURE AND NATURAL RESOURCES EDUCATION INSTITUTE
VOCATIONAL AGRICULTURE RESEARCH PROJECT PERFORMANCE OBJECTIVES

Program Area: Agricultural Mechanics

USOE Code Number: 01.03 01

MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
SERVICING AND REPAIRING ELECTRICAL SYSTEMS IN FARM TRACTORS References are on page 67	1. When provided equipment used to diagnose defects in the electrical system of farm tractors, and given a tractor with malfunctions in the starting circuit, lighting and accessory circuits,	the student will select and use the equipment in diagnosing the malfunctions in the electrical system,	by following approved trouble-shooting procedures detailed in a given service manual and to the previously established standards of the instructor or the person he/she designates.
	2. When provided equipment used to repair the defects in the electrical system of farm tractors, with defects in the charging circuit,	the student will select and use the equipment to remove, disassemble, test, inspect, replace, reassemble, and install the following parts in the charging circuit: a. Generator b. Voltage Regulator c. Alternator (If the engine is so equipped.),	according to the procedures in a given service manual and to the previously established standards of the instructor or a person he/she designates.
	3. When provided equipment used to repair defects in the electrical system of farm tractors, and given a farm tractor with malfunctions in the starting circuit,	the student will select and use the equipment to remove, disassemble, inspect, test, replace, reassemble, and install the following parts in the starting circuit: a. Starting motor b. Starting switch c. External solenoid,	according to the procedures in a given service manual and to the previously established standards of the instructor or a person he/she designates.

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MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
SERVICING AND REPAIRING ELECTRICAL SYSTEMS IN FARM TRACTORS	4. When provided equipment used to repair defects in the electrical systems of farm tractors, and given a farm tractor with malfunctions in the lighting and/or accessory circuit,	the student will select and use the equipment to remove, inspect, service and install the following parts in the lighting and/or accessory circuits: a. Switches b. Fuses c. Wires d. Gauges,	according to the procedures in a given service manual and to the previously established standards of the instructor or a person he/she designates.

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MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
SERVICING AND REPAIRING IGNITION SYSTEMS IN FARM TRACTORS	1. Given access to a farm tractor with malfunctions in the ignition system, and equipment used for checking defects in the system,	the student will select and use the equipment in diagnosing the nature of the malfunction,	by following the approved troubleshooting procedures in given service manual and to the previously established standards of the instructor or a person he/she designates.
References are on page 69	2. Given access to a farm tractor with malfunctions in the ignition system, and equipment used for correcting malfunctions in the system,	the student will select and use the appropriate equipment to remove, inspect, and test the following components of the system: a. Spark plugs b. Ignition wires c. Distributor d. Coil e. Points and Condenser f. Battery,	according to directions in given service manual and to the previously established standards of the instructor or a person he/she designates.
	3. Given access to a farm tractor with identified problems in the ignition circuit, and equipment used for correcting the problems,	the student will select and use the appropriate equipment to replace or service, install and adjust when necessary the following components of the ignition system: a. Spark plugs b. Ignition wires c. Distributor d. Coil e. Points and Condenser f. Battery,	according to directions and specifications in given service manual and to the previously established standards of the instructor or a person he/she designates.

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MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
SERVICING AND REPAIRING GASOLINE FUEL SYSTEMS ON FARM TRACTORS References are on page 70	1. Given access to a farm tractor which uses gasoline fuel, with observable symptoms of malfunction in the fuel system, and equipment used to diagnose the symptoms in the system,	the student will select and use the equipment in diagnosing the nature of the malfunctions in the fuel system,	by following appropriate troubleshooting procedures as detailed in given service manual and to the previously established standards of the instructor or a person he/she designates.
	2. Given access to a farm tractor which uses gasoline fuel with defects in the fuel system, and equipment used to disassemble the system,	the student will select and use the equipment to remove, disassemble, and inspect the following components of the gasoline fuel system: a. Fuel tank b. Fuel lines c. Air cleaner d. Fuel filter e. Carburetor f. Fuel pump	by following the procedures in given service manual and to the previously established standards of the instructor of a person he/she designates.
	3. Given access to a farm tractor which uses gasoline fuel, with defects in the system, and equipment used to repair the fuel system,	the student will use the appropriate equipment to replace, reassemble, install, and adjust the following components to the gasoline fuel system: a. Fuel tank b. Fuel lines c. Air cleaner d. Fuel filter e. Carburetor f. Fuel pump	according to manufacturer's specifications and to the previously established standards of the instructor or a person he/she designates.

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MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
SERVICING AND REPAIRING THE CLUTCH ASSEMBLY IN FARM TRACTORS References are on page 71	1. Given access to a farm tractor with defects in the clutch assembly, and equipment used for checking defects in the system,	the student will select and use the appropriate equipment in diagnosing the nature of the defects,	by following the appropriate troubleshooting procedures as detailed in given service manual and to the previously established standards of the instructor or a person he/she designates.
	2. Given access to a farm tractor with clutch assembly that has an incorrect amount of free pedal travel, and equipment for adjusting the clutch assembly,	the student will select and use the equipment to adjust the clutch linkage and lubricate the clutch release bearing,	by following procedures in given service manual and to the previously established standards of the instructor or a person he/she designates.
	3. Given access to a farm tractor with defects in the clutch assembly, and equipment used to repair the system,	the student will select and use the equipment to remove, disassemble, inspect, repair, reassemble, and install the following components of the clutch assembly: a. Clutch disk b. Pressure plate c. Pilot bearing and release bearing d. Clutch springs e. Clutch shaft f. Flywheel	according to manufacturer's directions and specifications and to the previously established standards of the instructor or a person he/she designates.

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MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
SERVICING AND REPAIRING THE DIFFERENTIAL AND FINAL DRIVE ASSEMBLY IN FARM TRACTORS	1. Given access to a farm tractor with symptons that indicate malfunctions in the differential and/or final drive assembly, and equipment used for checking defects in the two systems,	the student will select and use the equipment in diagnosing the nature of the malfunctions in the differential and final drive assembly,	by following the procedures described in given service manual and to the previously established standards of the instructor or a person he/she designates.
References are on page 71	2. Given access to a farm tractor with differential and final drive assembly, and equipment to service the two systems,	the student will select and use the equipment in performing general servicing requirements (e.g. checking and adding oil, flushing rear axle housing),	by following procedures in given service manual and to the previously established standards of the instructor or a person he/she designates.
	3. Given access to a farm tractor with defects in the final drive assembly, and equipment used for eliminating the problems,	the student will select and use the equipment to remove, disassemble, inspect, replace, reassemble, install, and adjust the components in the differential,	according to instructions in given repair manual and to the previously established standards of the instructor or a person he/she designates.

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MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
SERVICING AND REPAIRING THE COOLING SYSTEM IN FARM TRACTORS	1. Given access to a farm tractor with defects in the cooling system, and equipment used to diagnose the defects in the system,	the student will select and use the equipment to diagnose the nature of the defects in the cooling system,	by following procedures described in given service manual and to the previously established standards of the instructor or a person he/she designates.
References are on page 72	2. Given access to a farm tractor with cooling system, and equipment used to service the system,	the student will select and use the equipment to clean and service the cooling system,	by following directions in given service manual, labels on the coolant containers used, and to the previously established standards of the instructor or a person he/she designates.
	3. Given access to a farm tractor with identified defects in the cooling system, and equipment used to repair the defects in the system,	the student will select and use the equipment to remove, disassemble, inspect, and test the following parts of the cooling system: a. Fan belt and fan b. Radiator hoses c. Thermostat d. Radiator e. Water pump f. Water filter	according to procedures in given service manual and to the previously established standards of the instructor or a person he/she designates.

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MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
SERVICING AND REPAIRING THE COOLING SYSTEM IN FARM TRACTORS	4. Given access to a farm tractor with identified defects in the cooling system, and equipment to repair the defects in the system,	the student will select and use the equipment to replace, reassemble, install, and adjust the following parts of the cooling system: a. Fan belt and fan b. Radiator hoses c. Thermostat d. Radiator e. Water pump f. Water filter	by following the procedures in given service manual and to the previously established standards of the instructor or a person he/she designates.

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MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
SERVICING AND REPAIRING LP-GAS FUEL SYSTEMS ON FARM TRACTORS	1. Given access to a farm tractor which uses LP-Gas fuel, and equipment and materials for testing for leaks in the system,	the student will select and use the equipment and materials in testing the LP-Gas fuel system for leaks,	by following the procedures described in given service manual and to the previously established standards of the instructor.
References are on page 73	2. Given access to a farm tractor which uses LP-Gas and with defects in the fuel system, and equipment used to diagnose the symptoms in the system,	the student will select and use the equipment for diagnosing the defects in the LP-Gas fuel system,	by following appropriate troubleshooting procedures as detailed in given service manual and to the previously established standards of the instructor.
	3. Given access to a farm tractor which uses LP-Gas fuel with possible defects in the fuel system, with equipment used to remove and disassemble the system,	the student will select and use the equipment to remove, disassemble, and inspect the following components of the system: a. Fuel strainer or filter b. Air cleaner c. Carburetor d. Regulator e. Tank	by following procedures in given service manual and to the previously established standards of the instructor or person designated.
	4. Given access to a farm tractor which uses LP-Gas fuel with identified defects in the fuel system, and with equipment used to repair the system,	the student will select and use the equipment to reassemble, replace, install, and adjust the following components of the systems: a. Fuel strainer or filter b. Air cleaner c. Carburetor d. Regulator e. Tank	by following the manufacturer's directions and specifications and to the previously established standards of the instructor or a person designated

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MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
SERVICING AND REPAIRING DIESEL FUEL SYSTEMS ON FARM TRACTORS References are on page 73	1. Given access to a farm tractor which uses diesel fuel with defects or problems in the diesel fuel system, and equipment used for checking the problems in the system,	the student will select and use the equipment in diagnosing the nature of the malfunctions in the system,	by following appropriate troubleshooting procedures as detailed in given service manual and to the previously established standards of the instructor.
	2. Given access to a farm tractor which uses diesel fuel with air in the fuel system, and the equipment used for bleeding the system,	the student will select and use the equipment to bleed the air from the system,	by following the procedures outlined in given service manual.
	3. When provided a farm tractor which uses diesel fuel, with defects or problems in the fuel system, and the equipment for making repairs,	the student will select and use the equipment to remove, disassemble, and inspect the following components of the diesel fuel system: a. Fuel tank b. Fuel pump c. Fuel filter d. Fuel lines e. Injection pump f. Injection nozzles g. Air cleaner	according to the directions in given service manual and to the previously established standards of the instructor.

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MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
SERVICING AND REPAIRING DIESEL FUEL SYSTEMS ON FARM TRACTORS	4. Given access to a farm tractor which uses diesel fuel with defects in the fuel system, and the equipment used for repairing the system,	the student will select and use the equipment to replace, repair, reassemble, install, and adjust the following components of the diesel fuel system: a. Fuel tank b. Fuel pump c. Fuel filter d. Fuel lines e. Injection pump f. Injection nozzles g. Air cleaner,	according to the instructions in given service manual and to the previously established standards of the instructor.

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MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
INSPECTING AND REPAIRING PISTON AND CONNECTING ROD ASSEMBLY IN FARM TRACTORS	1. Given access to a farm tractor with problems or defects in the piston and rod assembly, and equipment used to diagnose the defects,	the student will select and use the appropriate equipment to diagnose the nature of the defects,	by following troubleshooting and inspection procedures as described in given service manual and to the previously established standards of the instructor.
References are on page 74	2. Given access to a farm tractor with defects in the piston and rod assembly, and access to appropriate tools and equipment,	the student will select and use the appropriate required equipment to remove and/or disassemble and inspect the following components of the piston and rod assembly for defects: a. Piston b. Piston rings c. Wrist pins d. Connecting rod e. Connecting rod bearings,	according to directions and procedures described in given service manual and to the previously established standards of the instructor.
	3. Given the components of the rod and piston assembly in farm tractors, and equipment used for making repairs and servicing,	the student will select and use the appropriate equipment to replace, repair, service, reassemble, adjust, and install the following components in the rod and piston assembly: a. Piston b. Piston ring c. Wrist pins or piston pins d. Connecting rod e. Connecting rod bearings,	by following recommended procedures in given service manual and to the previously established standards of the instructor.

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MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
DISASSEMBLING AND OVERHAULING THE ENGINE BLOCK AND HEAD IN FARM TRACTORS References are on page 74	1. Given access to a farm tractor with observable defects in the engine, and equipment used to diagnose the defects,	the student will select and use the appropriate equipment to diagnose the nature of the following defects: a. Excessive engine knock b. Excessive engine vibration c. Low oil pressure d. Lack of power e. Irregularly running engine f. Difficulty in starting g. Excessive fuel consumption h. Excessive oil consumption i. Excessive engine noise j. Loss of water from overheating,	by following approved troubleshooting procedures detailed in given service manual and to the previously established standards of the instructor.
	2. Given access to a farm tractor, an engine repair stand, and access to tools and equipment,	the student will select and use given equipment to drain coolant, remove and mount engine on repair stand,	by following steps in given service manual and to the previously established standards of the instructor.
	3. Given access to a farm tractor engine which has been mounted on a repair stand,	the student will select and use given equipment to perform the following tasks: a. Remove cylinder head nuts from block b. Remove cylinder head gaskets and clean surface on head and block c. Inspect the cylinder head for defects d. Remove the rocker arm assembly,	according to procedures in given service manual and to the previously established standards of the instructor.

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MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
DISASSEMBLING AND OVERHAULING THE ENGINE BLOCK AND HEAD IN FARM TRACTORS	4. Given a tractor engine block on a repair stand, and access to tools and equipment,	the student will perform the following tasks, using appropriate equipment: a. Remove lifting eyes from head b. Compress valve springs and remove locks c. Release springs and remove retainer, springs, rotor, and valves d. Place valves in a rack to original position e. Inspect valves and seats f. Inspect valve g. Inspect valve springs h. Inspect cylinder block and cylinder walls for cracks and other defects i. Measure the cylinder walls for tapering or distortion j. Clean engine block	by following procedures in given service manual and to the previously established standards of the instructor.

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MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
SERVICING AND REPAIRING THE STEERING SYSTEM IN FARM TRACTORS	1. Given access to a farm tractor with malfunctions in the steering mechanism and equipment used for checking defects in the system,	the student will select and use the equipment to diagnose the nature of the malfunctions in the steering system,	following approved trouble-shooting procedures as detailed in given service manual and to the previously established standards of the instructor.
References are on page 75	2. Given access to a farm tractor with defects in the steering system, and equipment to repair the defects,	the student will select and use the equipment to remove, inspect, disassemble, repair, service, reassemble, and install components in the steering system,	following directions in given service manual and to the previously established standards of the instructor.
	3. Given access to a farm tractor with a steering system to be adjusted, and the equipment used to make adjustments,	the student will select and use the equipment to adjust the alignment and toe-in of the steering system,	following the directions in given service manual and to the previously established standards of the instructor.

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MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
SERVICING AND REPAIRING THE HYDRAULIC SYSTEM IN FARM TRACTORS	1. Given access to a farm tractor with malfunctions in the hydraulic system, and equipment used for checking the defects,	the student will select and use the equipment in diagnosing the nature of the malfunctions in the hydraulic system,	by following appropriate troubleshooting directions in given service manual and to the previously established standards of the instructor.
References are on page 75	2. Given access to a farm tractor with hydraulic system, and equipment used to service the system,	the student will select and use the equipment to service the hydraulic system such as: a. Change filters b. Change and add oil c. Check the system for leaks d. Clean and flush the system,	by following the directions and recommendations detailed in given service manual and to the previously established standards of the instructor.
	3. Given access to a farm tractor with defects in the hydraulic system, and equipment used to make repairs,	the student will select and use the equipment to remove, disassemble, repair, service, reassemble, install, and adjust the following components of the hydraulic system: a. Hydraulic pump b. Hydraulic cylinder c. Hydraulic valves d. Hydraulic filters e. Lines and fittings f. Hydraulic motors g. Hydraulic accumulators h. Hydraulic seals i. Reserviors, oil coolers, hoses, pipes, tubes, and couplers	by following the manufacturer's directions and specifications and to the previously established standards of the instructor.

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MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
SERVICING AND REPAIRING THE BRAKE SYSTEM IN FARM TRACTORS	1. Given access to a farm tractor with observable defects in the brake system, and equipment used to diagnose the defects,	the student will select and use the equipment to diagnose the nature of the defects,	by following approved trouble-shooting procedures in given service manual and to the previously established standards of the instructor.
References are on page 76	2. Given access to a farm tractor with a braking system, and equipment used to adjust the brakes,	the student will select and use the equipment to adjust the brakes and service the system,	by following the procedures in given service manual and to the previously established standards of the instructor.
	3. Given access to a farm tractor with defects in the brake system, and equipment used to repair the brakes,	the student will select and use the equipment to remove, disassemble, inspect, repair, service, reassemble, and install the brake system,	by following the procedures detailed in the given service manual and to the previously established standards of the instructor.

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MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
SERVICING AND REPAIRING THE POWER TAKE-OFF ASSEMBLY IN FARM TRACTORS	1. Given access to a farm tractor with observable malfunctions in the power take-off, and equipment used for diagnosing defects in the power take-off system,	the student will select and use the equipment in diagnosing the nature of the defects in the power take-off system,	by following approved procedures in given service manual.
References are on page 77	2. Given access to a farm tractor with a power take-off assembly, and equipment used to service the system,	the student will select and use the equipment to service the power take-off system (such as replacing the safety shields and universal joints),	by following the procedures recommended by the manufacturer and to the previously established standards of the instructor.
	3. Given access to a farm tractor with identified defects in the power take-off assembly and the drive shaft, and equipment used for eliminating the defects in the system,	the student will select and use the equipment to remove, disassemble, inspect, service, reassemble, and install the power take-off assembly,	by following the procedures in given service manual and to the previously established standards of the instructor.

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MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
SERVICING AND REPAIRING THE AIR CONDITIONING SYSTEM ON FARM TRACTORS	1. Given access to a farm tractor with malfunctions in the air conditioning system, and equipment used for checking the defects in the system,	the student will select and use the equipment in diagnosing the nature of the malfunctions in the air conditioning system,	by following the appropriate troubleshooting procedures detailed in given service manual.
References are on page 77	2. Given access to a farm tractor with an air conditioning system, and equipment used to service the system,	the student will service the air conditioning system by performing such task as: a. Check evaporator core for accumulation of dirt and debris and clean if necessary b. Check refrigerant level c. Check compressor drive belt for tightness d. Replace hose protective material and hoses,	according to directions in given service manual and to the previously established standards of the instructor.
	3. Given access to a farm tractor with malfunctions in the air conditioning system, and equipment used to replace parts,	the student will select and use the equipment to replace the following component parts in the air conditioning system: a. Compressor b. Condensor c. Evaporator d. Circuits and valves,	according to directions in given service manual and to the previously established standards of the instructor.

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MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
SERVICING AND REPAIRING TRANSMISSION IN FARM TRACTORS	1. Given access to a farm tractor with defects in the transmission system, and equipment used to diagnose,	the student will select and use the appropriate equipment to diagnose the nature of the defects,	according to approved transmission troubleshooting procedures in given service manual.
References are on page 77	2. Given access to a farm tractor transmission system, and access to tools and equipment,	the student will select and use the equipment to perform the following tasks on the transmission system of a farm tractor: a. Remove the system b. Disassemble the system c. Inspect the system d. Reassemble the system e. Replace parts f. Install the system g. Make adjustments,	by following procedures in given service manual and to the previously established standards of the instructor.
	3. Given a farm tractor, and access to equipment and supplies,	the student will select and use the appropriate equipment to check and/or change the transmission oil in farm tractors,	according to directions and specifications in given service manual and to the previously established standards of the instructor.

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MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
INSPECTING AND REPAIRING THE CRANKSHAFT AND FLY-WHEEL ASSEMBLY IN FARM TRACTORS	1. When given an engine of a farm tractor with observable symptoms of crankshaft or flywheel problems, and equipment used to diagnose the malfunction,	the student will select and use the equipment to diagnose the nature of the defect(s) in the crankshaft and flywheel assembly,	by following proper trouble-shooting procedures detailed in given service manual.
References are on page 78	2. When given an engine of a farm tractor with defects of maladjustments in the crankshaft and flywheel assembly, and equipment to service and repair the malfunction,	the student will select and use the appropriate equipment to remove and/or disassemble and inspect the following components for defects: a. Crankshaft b. Main bearings c. Crankshaft timing gear d. Flywheel f. Flywheel ring gear	by following instructions in given repair manual and to the previously established standards of the instructor.
	3. When given an engine of a farm tractor in which the defects in the crankshaft and flywheel assembly have been identified, and equipment to service and repair the malfunction,	the student will select and use appropriate equipment to repair or service, reassemble, install, and adjust the following components of the crankshaft and flywheel assembly: a. Crankshaft b. Main bearings c. Crankshaft timing gear d. Flywheel e. Flywheel ring gear	by following instructions shown in given repair manual and to the previously established standards of the instructor.

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MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
REPAIRING THE VALVE SYSTEMS IN FARM TRACTORS References are on page 78	1. Given access to the engine of a farm tractor with defects in the valve system, and the appropriate tools for making repairs,	the student will select and use the appropriate tools to perform the following tasks: a. Replace valve guide b. Install Valve seat inserts c. Reface valves d. Reface valve seat,	by following procedures in given manual and to the previously established standards of the instructor.
	2. Given access to a farm tractor, replacement or repaired valve parts, and access to tools and equipment,	the student will select and use the desired equipment to perform the following tasks: a. Install intake and exhaust valves b. Install exhaust rotors c. Install springs and retainers d. Install and compress valve springs e. Install locks,	by following procedures in given service manual and to the previously established standards of the instructor.
	3. Given the engine of a farm tractor with disassembled parts, and access to tools and equipment,	the student will select and use desired equipment to perform the following tasks: a. Install head gasket b. Install head assemblies on block c. Install head nuts and tighten d. Retighten cylinder head nuts and reset valve clearance after specified hours of operation	by following the procedures in given service manual and to the previously established standards of the instructor.

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MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
REPAIRING THE VALVE SYSTEMS IN FARM TRACTORS		e. Install injectors and seals in head f. Connect bleed off lines to injectors and high pressure lines between pump and injectors g. Install push rods, rocker arm assemblies, cylinder head covers and breather h. Install intake and exhaust manifolds, water manifold, hoses, and thermostat housing i. Connect wire to water temperature gauge sender j. Install engine coolant	

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SERVICING AND REPAIRING THE GOVERNOR SYSTEM ON FARM TRACTORS References are on page 79	1. Given access to a farm tractor with a spark ignition engine which has malfunctions in the governor system, and equipment to diagnose the malfunction,	the student will select and use the equipment to diagnose the nature of the malfunction,	by following procedures detailed in given service manual.
	2. Given an engine of a farm tractor with a spark ignition system in which maladjustments have been identified in the governor system, and equipment used to make repairs,	the student will select and use the equipment to adjust the governor screw or replace the governor spring,	according to directions in given service manual and to the previously established standards of the instructor.
	3. Given an engine of a farm tractor in which defects have been identified in the governor system, and equipment used to make repairs,	the student will select and use the equipment to perform the following tasks: a. Remove the governor assembly b. Clean the components c. Replace components if necessary d. Reassemble the system e. Install the governor assembly,	according to directions in given service manual and to the previously established standards of the instructor.
	4. Given access to a farm tractor with a diesel engine and defects in the governor assembly, and equipment to make adjustments,	the student will select and use the equipment to adjust the governor assembly on a diesel engine,	by following the recommendations of given service manual and to the previously established standards of the instructor.

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Program Area: Agricultural Mechanics **USOE Code Number:** 01.03 01

MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
SERVICING AND REPAIRING WHEELS, TIRES, AND TRACKS ON FARM TRACTORS	1. Given access to farm tractors with maladjustments in the wheel or track assembly, and the equipment to diagnose the problem,	the student will select and use desired equipment to diagnose the nature of the problem,	by following procedures in given service manual and to the previously established standards of the instructor.
References are on page 80	2. Given access to a farm tractor with defects in the wheel assembly, and equipment to make repairs,	the student will select and use appropriate equipment to perform the following tasks: a. Remove the wheel b. Replace or repack wheel bearings c. Replace the seals d. Install and adjust the bearings e. Replace the wheel,	according to directions in given service manual and to the previously established standards of the instructor.
	3. Given access to a farm tractor with defects in the track and idler assembly, and equipment used for making repairs,	the student will select and use appropriate equipment to perform the following tasks: a. Remove the track b. Remove and replace idler wheels c. Remove and replace track rollers d. Install and adjust the track,	according to procedures shown in given service manual and to previously established standards of the instructor.

AGRICULTURE AND NATURAL RESOURCES EDUCATION INSTITUTE

VOCATIONAL AGRICULTURE RESEARCH PROJECT PERFORMANCE OBJECTIVES

Program Area: Agricultural Mechanics **USOE Code Number:** 01.03 01

MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
LUBRICATING AND GREASING FARM TRACTORS References are on page 80	1. Given access to a farm tractor in which the oil needs to be changed, the oil filter replaced, and the crankcase breather serviced,	the student will select and use the appropriate equipment to perform the following tasks: a. Change crankcase oil b. Replace oil filter c. Service crankcase breather,	by following procedures and recommendations in given service manual and to the previously established standards of the instructor.
	2. Given access to a farm tractor in which the oil pressure gauge, oil pump and other parts in the lubrication system are defective, and equipment used to make repairs,	the student will select and use the appropriate tools to replace and adjust oil pressure gauges and other parts in the lubrication system,	according to directions in given service manual and to the previously established standards of the instructor.

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VOCATIONAL AGRICULTURE RESEARCH PROJECT PERFORMANCE OBJECTIVES

Program Area: Agricultural Mechanics **USOE Code Number:** 01.03 01

MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
CLEANING AND STORING FARM TRACTORS References are on page 81	1. Given access to a farm tractor which needs to be cleaned, and equipment used for cleaning,	the student will select and use the equipment to clean the farm tractor,	so well that the appearance of the tractor is enhanced and the tasks performed by the student meet the previously established standards of the instructor.
	2. Given a farm tractor, and access to tools, equipment, and supplies for cleaning,	the student will select and use the tools, equipment, and supplies to perform the following tasks before storing the farm tractor: a. perform engine tune-up b. drain and refill transmission with fresh oil c. add corrosion and rust inhibitor to oil d. clean and repack wheel bearings e. drain and refill hydraulic system f. park tractor in selected storage location g. drain fuel tank h. remove, clean, and replace fuel sediment bowl and filters i. drain fuel lines and carburetor, and seal ends of air inlet pipe, exhaust pipe, crankcase breather pipe, and hydraulic system breather pipe j. remove and charge battery k. remove weights from machine and tires,	according to directions in given service manual and to the previously established standards of the instructor.

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VOCATIONAL AGRICULTURE RESEARCH PROJECT PERFORMANCE OBJECTIVES

Program Area: Agricultural Mechanics **USOE Code Number:** 01.03 01

MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
CLEANING AND STORING FARM TRACTORS		l. Remove tires or raise machine so that tires are off the ground m. Release the tension on all drive belts and chains and apply grease n. Lubricate all points normally requiring lubrication	

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VOCATIONAL AGRICULTURE RESEARCH PROJECT PERFORMANCE OBJECTIVES

Program Area: Agricultural Mechanics

USOE Code Number: 01.03 01

MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
ASSEMBLING, ADJUSTING, REPAIRING AND/OR SERVICING FARM TILLAGE EQUIPMENT	1. Given the parts to knocked-down farm tillage equipment,	the student will inspect the bundles for missing parts and assemble the various types of tillage equipment,	according to the directions in given operator's instructional manual and to the previously established standards of the instructor.
References are on page 81	2. Given tools and the assembled farm tillage equipment,	the student will select and use the appropriate tools to make initial adjustments and to service the tillage equipment before using,	with adjustments within 95% of specifications in the manual.
	3. Given the transportation equipment and the assembled tillage farm equipment,	the student will use the equipment in loading, transporting, and unloading the tillage equipment at the proper location,	without damaging the equipment and to the previously established standards of the instructor.
	4. Given the various types of malfunctioning tillage equipment, and access to tools,	the student will select and use the tools to service and/or repair tillage equipment,	with adjustments within 95% of specifications in the manual.

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USOE Code Number: 01.03 01

MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
ASSEMBLING, ADJUSTING, REPAIRING, AND/OR SERVICING FARM PLANTING EQUIPMENT	1. Given the parts to knocked-down farm planting equipment,	the student will inspect the bundles for missing parts and assemble the various types of planting equipment,	according to the directions in given operator's instructional manual and to the previously established standards of the instructor.
References are on page 82	2. Given tools and the assembled farm planting equipment,	the student will select and use the appropriate tools to make initial adjustments and service the planting equipment before planting grain crops,	with adjustments within 95% of specifications in the manual.
	3. Given the transportation equipment and assembled planting equipment,	the student will use the equipment in loading, transporting, and unloading the planting equipment at the desired location,	without damaging the equipment and to the previously established standards of the instructor.
	4. Given the types of malfunctioning planting equipment, and access to tools,	the student will select and use the tools to service and/or repair planting equipment,	with adjustments within 95% of specifications in the manual.

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VOCATIONAL AGRICULTURE RESEARCH PROJECT PERFORMANCE OBJECTIVES

Program Area: Agricultural Mechanics

USOE Code Number: 01.03 01

MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
ASSEMBLING, ADJUSTING, REPAIRING, AND/OR SERIVICING FARM FERTILIZER APPLICATION EQUIPMENT References are on page 82	1. Given access to knocked-down fertilizer application equipment, and the appropriate tools for assembling, and adjusting,	the student will: a. Inspect the bundles for missing parts and arrange the parts for assembling b. Assemble the fertilizer application equipment c. Adjust the fertilizer application equipment d. Service the fertilizer application equipment before apply fertilizer,	according to the directions in given manufacturuer's manual and with 95% accuracy in assembly and adjustment and so that the equipment operates safely and efficiently.
	2. Given the transportation equipment and the task of transporting the assembled fertilizer applicator,	the student will perform the following tasks with the fertilizer applicator: a. Load b. Transport c. Unload	without damaging the equipment, or injuring people, and within a time period previously established by the instructor.
	3. Given access to various types of fertilizer application equipment,	the student will perform the following tasks on fertilizer application equipment: a. Service appropriate parts b. Repair damaged or broken parts c. Clean and store,	according to directions in given operator's manual so that the equipment continues to operate safely and efficiently.

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VOCATIONAL AGRICULTURE RESEARCH PROJECT PERFORMANCE OBJECTIVES

Program Area: Agricultural Mechanics **USOE Code Number:** 01.03 01

MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
ASSEMBLING, ADJUSTING, REPAIRING, AND/OR SERVICING OF SPRAYING AND DUSTING APPLICATION FARM EQUIPMENT	1. Given the parts to various types of knocked-down spraying and dusting farm equipment,	the student will inspect the bundles for missing parts and assemble the various types of equipment,	according to the directions in given operator's instructional manual and to the previously established standards of the instructor.
References are on page 83	2. Given tools and assembled spraying and dusting farm equipment,	the student will select and use the appropriate tools to make initial adjustments and service the equipment before using,	according to the directions in given operator's instructional manual and to the previously established standards of the instructor.
	3. Given the vehicles and the assembled spraying and dusting farm equipment,	the student will use the vehicles to load, transport, and unload the spraying and dusting farm equipment,	without damaging the equipment and to the previously established standards of the instructor.
	4. Given the tools and various types of malfunctioning farm spray and dusting equipment,	the student will select and use the tools to service and/or repair the equipment,	according to directions in operator's instructional manual and to the previously established standards of the instructor.

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Program Area: Agricultural Mechanics

USOE Code Number: 01.03 01

MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
ASSEMBLING, ADJUSTING, REPAIRING, AND/OR SERVICING FARM CULTIVATION EQUIPMENT References are on page 83	1. Given access to knocked-down farm cultivation equipment and the appropriate tools for assembling and adjusting,	the student will: a. Inspect the bundles for missing parts and arrange the parts for assembling b. Assemble the farm cultivation equipment c. Adjust the cultivation equipment d. Service the cultivation equipment,	according to the directions in given manufacturer's manual so that the equipment operates safely and efficiently.
	2. Given the transportation equipment and assembled farm cultivation equipment,	the student will perform the following tasks with the cultivation equipment: a. Load b. Transport c. Unload	without damaging the equipment or injuring people, and within a previously established time period, established by the instructor.
	3. Given access to various types of farm cultivation equipment,	the student will perform the following tasks on the farm cultivation equipment: a. Service appropriate parts b. Repair damaged or broken parts c. Clean and store,	according to directions in given operator's manual with 95% accuracy in assembly and adjustment and so that the equipment will operate safely and efficiently.

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MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
ASSEMBLING, ADJUSTING, REPAIRING AND/OR SERVICING HARVESTING FARM EQUIPMENT	1. Given the parts of knocked-down farm harvesting equipment,	the student will inspect the bundles for missing parts and assemble the various types of harvesting equipment,	according to directions in given operator's instructional manual and to the previously established standards of the instructor.
References are on page 83	2. Given tools and assembled harvesting equipment,	the student will select and use the appropriate tools to make initial adjustments and service the harvesting equipment before using,	according to directions in given operator's instructional manual and to the previously established standards of the instructor.
	3. Given the transportation vehicles and the assembled harvesting equipment,	the student will use the vehicles in loading, transporting and unloading the harvesting equipment at the desired location,	without damaging the equipment and to the previously established standards of the instructor.
	4. Given the tools and various types of malfunctioning parts in the harvesting equipment,	the student will select and use the tools to service and/or repair the harvesting equipment,	according to directions detailed in the operator's instructional manual and to the previously established standards of the instructor.

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VOCATIONAL AGRICULTURE RESEARCH PROJECT PERFORMANCE OBJECTIVES

Program Area: Agricultural Mechanics

USOE Code Number: 01.03 99

MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
PERFORMING GENERAL OFFICE DUTIES References are on page 84	1. Given access to the type of office commonly found in an agricultural equipment repair shop,	the student will: a. Answer the telephone b. Clearly converse on the telephone c. Record adequate information from a call taken for someone else d. Place calls on the telephone e. Prepare and mail a business letter f. File various forms and reports g. Keep the office clean and organized h. Order needed parts for farm machinery	so that the communications in the office are clear, and the office is conducive for maximum output, and to the previously established standards of the instructor or employer.

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Program Area: Agricultural Mechanics

USOE Code Number: 01.03

MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
USING COMMUNICATION EQUIPMENT References are on page 85	1. Provided a two-way radio,	the student will operate the equipment,	in accordance to the Federal Communications Commission rules and adjust the squelch and volume to be clearly understood during communications, and to the previously established standards of the instructor or designated person.

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VOCATIONAL AGRICULTURE RESEARCH PROJECT PERFORMANCE OBJECTIVES

Program Area: Agricultural Mechanics

USOE Code Number: 01.03 05

MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
MEETING THE CUSTOMER	1. Given access to a school shop that repairs and services farm equipment for school patrons, or a simulated situation,	the student will: a. Meet the customer b. Listen and identify customer problem c. Explain what must be done to correct the malfunction,	so well that, in the opinion of a jury observing the interview, the customer will be likely to return for service in the future.
References are on page 85	2. Given access to a school shop that repairs and services farm equipment for school patrons, or a simulated situation and parts that have been replaced in a machine,	the student will show the replaced parts to the customer, point out the cause of the malfunction and explain the need for replacement,	so that, in the opinion of a jury observing the interview, the customer will likely return for service in the future.
	3. Given access to a school shop that repairs farm equipment for school patrons, or a simulated situation and a machine that has been repaired,	the student will explain what actually was done and offer additional services and/or merchandise,	so that, in the opinion of a jury, observing the interview, the customer will be likely to return for service in the future.

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VOCATIONAL AGRICULTURE RESEARCH PROJECT PERFORMANCE OBJECTIVES

Program Area: Agricultural Mechanics

USOE Code Number: 01.03 05

MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
PAINTING AGRICULTURAL EQUIPMENT	1. Given access to agricultural machinery to be cleaned before reconditiong, and the equipment used for cleaning,	the student will select and use the equipment to clean the agricultural machinery before reconditioning,	to the previously established standards of the instructor and by following directions in given operator's manual for the equipment used.
References are on page 85	2. Given access to cleaned agricultural machinery to be reconditioned, and equipment used to sand and prepare the equipment for painting,	the student will select and use the equipment to sand and feather-edge machinery for painting,	to the previously established standards of the instructor and according to the directions of the equipment manufacturer.
	3. Given agricultural equipment to be painted,	the student will select and mix the paint for application,	to the previously established standards of the instructor and according to the manufacturer's specifications.
	4. Given access to cleaned and sanded agricultural equipment to be primed, and mechanical spray painting equipment,	the student will safely operate the equipment in applying the primer coat so well that it,	meets the previously established standards of the instructor.
	5. Given access to mechanical spraying equipment, and the task of applying a finish coat(s) to agricultural equipment,	the student will properly operate the equipment in applying the finish coat(s) so well,	that the finish coat(s) meets previously established standards of the instructor.

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Program Area: Agricultural Mechanics

USOE Code Number: 01.03 05

MODULE TITLE	CONDITIONS	PERFORMANCE	CRITERIA
PAINTING AGRICULTURAL EQUIPMENT	6. Given the task of touching up agricultural equipment manually with hand tools,	the student will select and use hand tools in touching up the equipment so well that,	the finished product meets the previously established standards of the instructor.
	7. Given the task of servicing and cleaning mechanical spraying equipment, and of cleaning manual tools,	the student will select tools and solutions to service and clean mechanical equipment and clean manual equipment so well that,	the servicing and cleaning tasks are performed according to manufacturer's directions and to the previously established standards of the instructor.
	8. Given the task of storing manual and mechanical spraying equipment, and other materials used in painting agricultural equipment,	the student will organize and store the spraying equipment and materials in a specified area so well,	that the storing of the equipment and materials meets the previously established standards of the instructor.

APPENDIX B

Selected References for Teaching Agricultural Mechanics

MODULE TITLES	SELECTED REFERENCES	TYPE OF MATERIALS	AGDEX NUMBERS
SELECTING, USING, AND CARING FOR TOOLS AND EQUIPMENT IN AGRICULTURAL EQUIPMENT SHOPS	1. Rader, Thomas, ed. Fundamentals of Service: Shop Tools. Moline, Illinois: John Deere and Company, 1973. (IL/1).	Book, slides are also available for this document.	782
	2. Rader, Thomas, ed. Fundamentals of Machine Operation: Preventive Maintenance. Moline, Illinois: John Deere and Company, 1973. (IL/1)	Book, slides are also available for this document.	782
	3. See various tool catalogs for additional references related to this module title.		
	4. ABC's of Hand Tools. Detroit, Michigan: General Motors Corporation. (MI/4).	Pamphlet	782
	5. Wakeman, T.J. and McCoy, Vernon L. The Farm Shop. New York, New York: MacMillan Company, 1960. (NY/8).	Book	785
USING SAFETY AND SANITATION PRACTICES IN AGRICULTURAL EQUIPMENT SHOPS	1. Chemical Safety. St. Paul, Minnesota: Hobar Publications. (MN/1).	Transparencies	607
	2. Schmidt, Philip. RAP Bulletin: Power Tools. Chicago, Illinois: National Safety Council. (IL/6).	Bulletin	782
	3. Burke, Jack. RAP Bulletin: Personal Protective Equipment for Agriculture. Chicago, Illinois: National Safety Council. (IL/6).	Bulletin	900/80
	4. Burke, Jack. RAP Bulletin: Respiratory Protection in Agriculture. Chicago, Illinois: National Safety Council. (IL/6).	Bulletin	900/80
	5. Burke, Jack. RAP Bulletin: Hearing Protection in Agriculture. Chicago, Illinois: National Safety Council. (IL/6).	Bulletin	900/80
	6. Hanford, William D. RAP Bulletin: Falls Prevention in Agricultural Work. Chicago, Illinois: National Safety Council. (IL/6).	Bulletin	900

MODULE TITLES	SELECTED REFERENCES	TYPE OF MATERIALS	AGDEX NUMBERS
USING SAFETY AND SANITATION PRACTICES IN AGRICULTURAL EQUIPMENT SHOPS (cont.)	7. Rader, Thomas, ed. Fundamental of Service: Welding. Moline, Illinois: John Deere and Company, 1974. (IL/1).	Book, slides are also available for this document.	785
	8. Safety in the Agricultural Mechanics Shop. VAS 3022 Urbana, Illinois: Vocational Agriculture Service of the University of Illinois. (IL/2)	Pamphlet	780
	9. Handling and Using Gasoline and Liquefied Petroleum Gas Safety. VAS 3013. Urbana, Illinois: Vocational Agriculture Service of the University of Illinois. (IL/2).	Pamphlet	780
UNDERSTANDING FARM SAFETY AND USING SAFETY PRECAUTIONS IN OPERATING FARM MACHINERY	1. Borgman, Donald E., Hainline, Everette, and Long, Melvin E. Fundamentals of Machine Operation: Tractors. Moline, Illinois: John Deere and Company, 1974. (IL/1).	Books, slides are also available for this document.	762
	2. Bittner, Richard H., et. al. Fundamentals of Machine Operation: Agricultural Machinery Safety. Moline, Illinois: John Deere and Company, 1974. (IL/1).	Book, slides are also available for this document.	740
	3. Operating Farm Tractors and Machinery. St. Paul, Minnesota: Hobar Publications. (MN/1).	Transparencies	762
	4. Farm Machinery Operation. St. Paul, Minnesota: Hobar Publications. (MN/1).	Transparencies	740
	5. Chemical Safety. St. Paul, Minnesota. Hobar Publications. (MN/1).	Transparencies	607
	6. Griffen, George A. Fundamentals of Machine Operation: Combine Harvesting. Moline, Illinois: John Deere and Company, 1973. (IL/1).	Book, slides are also available for this document.	740

MODULE TITLES	SELECTED REFERENCES	TYPE OF MATERIALS	AGDEX NUMBERS
UNDERSTANDING FARM SAFETY AND USING SAFETY PRECAUTIONS IN OPERATING FARM MACHINERY (cont.)	7. Silletto, T.A. and Hull, Dale O. Safe Operation of Agricultural Equipment. St. Paul; Minnesota: Hobar Publications, 1973. (MN/1).	Book	740
	8. Schmidt, Philip. RAP Bulletin: Power Tools. Chicago, Illinois: National Safety Council. (IL/6).	Bulletin	782
	9. Hanford, William D. RAP Bulletin: Tractor Safety Equipment. Chicago, Illinois: National Safety Council. (IL/6).	Bulletin	762
	10. Burke, Jack. RAP Bulletin: Personal Protective Equipment for Agriculture. Chicago, Illinois: National Safety Council. (IL/6).	Bulletin	900/80
	11. Burke, Jack. RAP Bulletin: Respiratory Protection in Agriculture. Chicago, Illinois: National Safety Council. (IL/6).	Bulletin	900/80
	12. Burke, Jack. RAP Bulletin: Hearing Protection in Agriculture. Chicago, Illinois: National Safety Council. (IL/6).	Bulletin	900/80
	13. Burke, Jack. RAP Bulletin: Fire Prevention on the Farm and Ranch. Chicago, Illinois: National Safety Council. (IL/6).	Bulletin	900/80
	14. Hanford, William D. and Burke, Jack. RAP Bulletin: Falls Prevention in Agricultural Work. Chicago, Illinois: National Safety Council. (IL/6).	Bulletin	900
	15. Fletcher, William J. RAP Bulletin: Safe Handling of Anhydrous Ammonia. Chicago, Illinois: National Safety Council. (IL/6).	Bulletin	743
	16. Fletcher, William J. RAP Bulletin: Fire Protection of Farm and Ranch. Chicago, Illinois: National Safety Council. (IL/6).	Bulletin	

MODULE TITLES	SELECTED REFERENCES	TYPE OF MATERIALS	AGDEX NUMBERS
UNDERSTANDING FARM SAFETY AND USING SAFETY PRECAUTIONS IN OPERATING FARM MACHINERY (cont.)	1. Burke, Jack, Fletcher, William J., and Hanford, William D. RAP Bulletin: Safe Movement of Farm Equipment on Public Roads. Chicago, Illinois: National Safety Council. (IL/6)	Bulletin	740
	18. Farm and Ranch Safety Guide. Chicago, Illinois: National Safety Council. (IL/6)	Book	
	19. Rader, Thomas, ed. Fundamentals of Service: Welding. Moline, Illinois: John Deere and Company, 1974. (IL/1).	Book, slides are also available for this document.	785
	20. Handling and Using Gasoline and Liquefied Petroleum Gas Safely. VAS 3013. Urbana, Illinois: Vocational Agriculture Service of the University of Illinois. (IL/1).	Bulletin	780
TROUBLESHOOTING THE ENGINES OF FARM TRACTORS	1. Hathaway, Louis. Fundamentals of Machine Operation: Preventive Maintenance. John Deere and Company, 1973. (IL/1)	Book, slides are also available for this document.	787
	2. Rader, Thomas, ed. Fundamentals of Service: Engines. Moline, Illinois: John Deere and Company, 1972. (IL/1).	Book, slides are also available for this document.	787
	3. Borgman, Donald E., Hainline, Everette, and Long, Melvin E. Fundamentals of Machine Operation: Tractors. Moline, Illinois: John Deere and Company, 1974. (IL/1).	Book, slides are also available for this document.	762
	4. The Spark Plug: Operation, Selection, and Maintenance. VAS 3026. Urbana, Illinois: Vocational Agriculture Service of the University of Illinois. (IL/2).	Pamphlet	787
	5. Engine Compression and Cylinder Leakage Testing. VAS 3025. Urbana, Illinois: Vocational Agriculture Service of the University of Illinois. (IL/2).	Pamphlet	787

MODULE TITLES	SELECTED REFERENCES	TYPE OF MATERIALS	AGDEX NUMBERS
TROUBLESHOOTING THE ENGINES OF FARM TRACTORS (cont.)	6. Use specific service and repair manuals for the type of machinery beint tested.		
OPERATING OXY-ACETYLENE WELDING EQUIPMENT	1. Althouse, Andrew D., Turnquist, Carl H., and Bowditch, William A. Modern Welding. South Holland, Illinois: Goodheart-Willcox Company, Inc. Publishers, 1970. (IL/3).	Book, Instructor's Guide also available.	785
	2. Phipps, Lloyd J. Mechanics in Agriculture. Danville, Illinois: The Interstate Printers and Publishers, Inc., 1970. (IL/7).	Textbook	785
	3. Rader, Thomas, ed. Fundamentals of Service: Welding. Moline, Illinois: John Deere and Company, 1974. (IL/3).	Book, slides are also available for this document.	785
	4. Using the Oxy-acetylene Flame in Farm Construction and Repair. VAS 3001. Urbana, Illinois: Vocational Agriculture Service of the University of Illinois. (IL/2).	Pamphlet	785
	5. Arc and Oxy-Welding (#504). Ames, Iowa: Iowa Association for Vocational Instructional Materials at Iowa State University. (IA/1).	Transparency Masters	785
	6. Walker, John R. Arc Welding: Basic Fundamentals. South Holland, Illinois: Goodheart-Willcox Company, Inc. Publishers, 1973. (IL/3).	Student manual, Instructor's Answer Key is also available.	785
OPERATING ARC WELDING EQUIPMENT	1. Althouse, Andrew D., Turnquist, Carl H., and Bowditch, William A. Modern Welding. South Holland, Illinois: The Goodheart-Willcox Company, Inc., Publishers, 1970. (IL/3).	Book, Instructor's Guide also available.	785

MODULE TITLES	SELECTED REFERENCES	TYPE OF MATERIALS	AGDEX NUMBERS
OPERATING ARC WELDING EQUIPMENT (cont.)	2. Phipps, Lloyd J. Mechanics in Agriculture. Danville, Illinois: The Interstate Printers and Publishers, Inc., 1970. (IL/7).	Textbook	785
	3. Rader, Thomas, ed. Fundamentals of Service: Welding. Moline, Illinois: John Deere and Company, 1974. (IL/1).	Book, slides are also available for this document.	785
	4. Wakeman, T.J. and McCoy, Vernon L. The Farm Shop. New York, New York: Macmillan Company, 1960. (NY/8).	Book	785
	5. Using the Carbon-Arctorch. VAS 3029. Urbana, Illinois: Vocational Agriculture Service of the University of Illinois. (IL/2).	Pamphlet	785
	6. Arc Welding. VAS 3004. Urbana, Illinois: Vocational Agriculture Service of the University of Illinois. (IL/2).	Pamphlet	785
	7. Arc Welding (#450-64, #451-64, #450-64). Urbana, Illinois: Vocational Agriculture Service of the University of Illinois. (IL/2).	Filmstrip	785
	8. Arc and Oxy-Welding (#504). Ames. Iowa: Iowa Association for Vocational Instructional Materials at Iowa State University. (IA/1).	Transparency Masters	785
SERVICING AND REPAIRING ELECTRICAL SYSTEMS IN FARM TRACTORS	1. Rader, Thomas, ed. Fundamentals of Service: Electrical Systems. Moline, Illinois: John Deere and Company, 1972. (IL/1).	Book, slides are also available for this document.	787
	2. Abbott, David C. and Lewis, Wiley B. Individual Study Guide on Electrical Systems for Spark-Ignition Engines. Columbus, Ohio: Ohio Agricultural Education Curriculum Materials Service at the Ohio State University, 1970. (OH/2).	Book	787

MODULE TITLES	SELECTED REFERENCES	TYPE OF MATERIALS	AGDEX NUMBERS
SERVICING AND REPAIRING ELECTRICAL SYSTEMS IN FARM TRACTORS (cont.)	3. Borgman, Donald E., Hainline, Everette, and Long, Melvin E. Fundamentals of Machine Operation: Tractors. Moline, Illinois: John Deere and Company, 1974. (IL/1).	Book, slides are also available for this document.	762
	4. Battery Ignition Systems. St. Paul, Minnesota: Hobar Publications, 1974. (MN/1).	Slide Set	787
	5. Parady, W. Howard and Turner, J. Howard. Tractor Maintenance Principles and Procedures. Athens, Georgia: American Association for Vocational Instructional Materials, 1975. (MI/1).	Book, slides are also available for this document.	787
	6. Hathaway, Louis. Fundamentals of Machine Operation: Preventive Maintenance. Moline, Illinois: John Deere and Company, 1974. (IL/1).	Book, slides are also available for this document.	787
	7. Farm and Industrial Equipment Institute. The Tractor Electrical System. Athens, Georgia: American Association for Vocational Instructional Materials. (MI/1).	Book	787
	8. Bryant, J.G., Turner, J. Howard, and Smith, George W. Farm Tractor Tune-Up and Service Specifications. Athens, Georgia: American Association for Vocational Instructional Materials, 1972. (MI/1).	Book	787
	9. Promersberger, William J., Bishop, Frank E., and Priebe, Donald W. Modern Farm Power. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1971. (NJ/1).	Textbook	787
	10. Use specific service and repair manuals for the type of tractor being serviced and repaired.		

MODULE TITLES	SELECTED REFERENCES	TYPE OF MATERIALS	AGDEX NUMBERS
SERVICING AND REPAIRING IGNITION SYSTEMS IN FARM TRACTORS	1. Farm and Industrial Equipment Institute. The Tractor Electrical System. Athens, Georgia: American Association for Vocational Instructional Materials. (MI/1).	Book	787
	2. Bryant, J.G., Turner, J. Howard, and Smith, George W. Farm Tractor Tune-Up and Service Specifications. Athens, Georgia: American Association for Vocational Instructional Materials, 1972. (MI/1).	Book	787
	3. Hathaway, Louis. Fundamentals of Machine Operation: Preventive Maintenance. Moline, Illinois: John Deere and Company, 1973. (IL/1).	Book, slides are also available for this document.	787
	4. Paraday, W. Harold and Turner, J. Howard. Tractor Maintenance Principles and Procedures. Athens, Georgia: American Association for Vocational Instructional Materials, 1975. (MI/1).	Book, slides are also available for this document.	787
	5. Battery Ignition Systems. St. Paul, Minnesota: Hobar Publications, 1974. (MN/1).	Slide Set	787
	6. Borgman, Donald E., Hainline, Everett, and Long, Melvin E. Fundamentals of Machine Operation: Tractors. Moline, Illinois: John Deere and Company, 1974. (IL/1).	Book, slides are also available for this document.	762
	7. Abbott, David C. and Lewis, Wiley B. Individual Study Guide on Electrical Systems for Spark Ignition Engines. Columbus, Ohio: Ohio Agricultural Education Curriculum Materials Service, Ohio State University, 1970. (OH/2).	Book	787
	8. Rader, Thomas, ed. Fundamentals of Service: Electrical Systems. Moline, Illinois: John Deere and Company, 1972. (IL/1).	Book, slides are also available for this document.	787

MODULE TITLES	SELECTED REFERENCES	TYPE OF MATERIALS	AGDEX NUMBERS
SERVICING AND REPAIRING IGNITION SYSTEMS IN FARM TRACTORS (cont.)	9. Promersberger, William J., Bishop, Frank E., and Priebe, Donald W. Modern Farm Power. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1971. (NJ/1).	Book	787
	10. The Ignition System--Testing and Analyzing Test Results. VAS 3028. Urbana, Illinois: Vocational Agriculture Service of the University of Illinois. (IL/2)	Pamphlet	787
	11. Farm Tractor Tune-Up. VAS 3008. Urbana, Illinois: Vocational Agriculture Service of the University of Illinois. (IL/2).	Pamphlet	787
	12. Use specific service and repair manual for the type of tractor being serviced and repaired.		
SERVICING AND REPAIRING GASOLINE FUEL SYSTEMS ON FARM TRACTORS	1. Hathaway, Louis. Fundamentals of Machine Operation: Preventive Maintenance. Moline, Illinois: John Deere and Company, 1973. (IL/1).	Book, slides are also available for this document.	787
	2. Rader, Thomas, ed. Fundamentals of Service: Engines. Moline, Illinois: John Deere and Company, 1972. (IL/1).	Book, slides are also available for this document.	787
	3. Borgman, Donald E., Hainline, Everette, and Long, Melvin E. Fundamentals of Machine Operation: Tractors. Moline, Illinois: John Deere and Company, 1974. (IL/1).	Book, slides are also available for this document.	762
	4. Promersberg, William J., Bishop, Frank E., and Priebe, Donald W. Modern Farm Power. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1971. (NJ/1).	Book	787
	5. Use specific service and repair manual for the type of tractor being serviced and repaired.		

MODULE TITLES	SELECTED REFERENCES	TYPE OF MATERIALS	AGDEX NUMBERS
SERVICING AND REPAIRING THE CLUTCH ASSEMBLY IN FARM TRACTORS	1. Parady, W. Harold and Turner, J. Howard. Tractor Maintenance Principles and Procedures. Athens, Georgia: American Association for Vocational Instructional Materials, 1975. (MI/1).	Book, slides are also available for this document.	787
	2. Borgman, Donald E., Hainline, Everette, and Long, Melvin E. Fundamentals of Machine Operation: Tractors. Moline, Illinois: John Deere and Company, 1972. (IL/1).	Book, slides are also available for this document.	762
	3. Rader, Thomas, ed. Fundamentals of Service: Power Trains. Moline, Illinois: John Deere and Company, 1972. (IL/1).	Book, slides are also available for this document.	787
	4. Bryant, J.G., Turner, J. Howard, and Smith, George W. Farm Tractor Tune-Up and Service Specifications. Athens, Georgia: American Association for Vocational Instructional Materials, 1972. (MI/1).	Book	787
	5. Use specific service and repair manual for type of tractor being serviced and repaired.		
SERVICING AND REPAIRING THE DIFFERENTIAL AND FINAL DRIVE ASSEMBLY IN FARM TRACTORS	1. Borgman, Donald E., Hainline, Everette, and Long, Melvin E. Fundamentals of Machine Operation: Tractors. Moline, Illinois: John Deere and Company, 1974. (IL/1).	Book, slides are also available for this document.	762
	2. Hathaway, Louis. Fundamentals of Machine Operation: Preventive Maintenance. Moline, Illinois: John Deere and Company, 1973. (IL/1).	Book, slides are also available for this document.	787
	3. Rader, Thomas, et al. Fundamentals of Service: Power Trains Moline, Illinois: John Deere and Company, 1972. (IL/1).	Book, slides are also available for this document.	787

MODULE TITLES	SELECTED REFERENCES	TYPE OF MATERIALS	AGDEX NUMBERS
SERVICING AND REPAIRING THE DIFFERENTIAL AND FINAL DRIVE ASSEMBLY IN FARM TRACTORS (cont.)	4. Parady, W. Harold and Turner, J. Howard. Tractor Maintenance Principles and Procedures. Athens, Georgia: American Association for Vocational Instructional Materials, 1975. (MI/1).	Book, slides are also available for this document.	787
	5. Use specific service and repair manual for type of tractor being serviced and repaired.		
SERVICING AND REPAIRING THE COOLING SYSTEM IN FARM TRACTORS	1. Paraday, W. Harold and Turner, J. Howard. Tractor Maintenance Principles and Procedures. Athens, Georgia: American Association for Vocational Instructional Materials, 1975. (MI/1).	Book, slides are also available for this document.	787
	2. Rader, Thomas, ed. Fundamentals of Service: Engines. Moline, Illinois: John Deere and Company, 1972. (IL/1).	Book, slides are also available for this document.	787
	3. Hathaway, Louis. Fundamentals of Machine Operation: Preventive Maintenance. Moline, Illinois: John Deere and Company, 1973. (IL/1).	Book, slides are also available for this document.	787
	4. Bryant, J.G., Turner, J. Howard, and Smith, George W. Farm Tractor Tune-Up and Service Specifications. Athens, Georgia: American Association for Vocational Instructional Materials, 1972. (MI/1).	Book	787
	5. Promersberger, William J., Bishop, Frank E., and Priebe, Donald W. Modern Farm Power. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1971. (NJ/1).	Book	787
	6. The Engine Cooling System. VAS 3030. Urbana, Illinois: Vocational Agriculture Service of the University of Illinois. (IL/2).	Pamphlet	787

MODULE TITLES	SELECTED REFERENCES	TYPE OF MATERIALS	AGDEX NUMBERS
SERVICING AND REPAIRING THE COOLING SYSTEM IN FARM TRACTORS (cont.)	7. Use specific service and repair manual for type of tractor being serviced and repaired.		
SERVICING AND REPAIRING LP-GAS FUEL SYSTEMS ON FARM TRACTORS	1. Borgman, Donald E., Hainline, Everette, and Long, Melvin E. Fundamentals of Machine Operation: Tractors. Moline, Illinois: John Deere and Company, 1974. (IL/1).	Book, slides are also available for this document.	762
	2. Hathaway, Louis. Fundamentals of Machine Operation: Preventive Maintenance. Moline, Illinois: John Deere and Company, 1973. (IL/1).	Book, slides are also available for this document.	787
	3. Rader, Thomas, ed. Fundamentals of Service: Engines. Moline, Illinois: John Deere and Company, 1972. (IL/1).	Book, slides are also available for this document.	787
	4. Use specific service and repair manual for type of tractor being serviced and repaired.		
SERVICING AND REPAIRING DIESEL FUEL SYSTEMS ON FARM TRACTORS	1. Parady, W. Harold and Turner, J. Howard. Tractor Maintenance Principles and Procedures. Athens, Georgia: American Association for Vocational Instructional Materials, 1975. (MI/1).	Book, slides are also available for this document.	787
	2. Rader, Thomas, ed. Fundamentals of Service: Engines. Moline, Illinios: John Deere and Company, 1972. (IL/1).	Book, slides are also available for this document.	787

MODULE TITLES	SELECTED REFERENCES	TYPE OF MATERIALS	AGDEX NUMBERS
SERVICING AND REPAIRING DIESEL FUEL SYSTEMS ON FARM TRACTORS (cont.)	3. Hathaway, Louis. Fundamentals of Machine Operation: Preventive Maintenance. Moline, Illinois: John Deere and Company, 1973. (IL/1).	Book, slides are also available	787
	4. Borgman, Donald E., Hainline, Everette, and Long, Melvin E. Fundamentals of Machine Operation: Tractors. Moline, Illinois: John Deere and Company, 1974. (IL/1).	Book, slides are also available for this document.	762
	5. Promersberger, William J., Bishop, Frank E., and Priebe, Donald W. Modern Farm Power. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1971. (NJ/1).	Book	787
	6. Toboldt, William K. Diesel: Fundamentals, Service, Repair. South Holland, Illinois: The Goodheart-Willcox Company, Inc., 1973. (IL/3).	Book	787
	7. Use specific service and repair manual for type of tractor being serviced and repaired.		
INSPECTING AND REPAIRING PISTON AND CONNECTING ROD ASSEMBLY IN FARM TRACTORS	1. Rader, Thomas, ed. Fundamentals of Service: Engines. Moline, Illinois: John Deere and Company, 1972. (IL/1).	Book, slides are also available for this document.	787
	2. Toboldt, William K. Diesel: Fundamentals, Service, Repair. South Holland, Illinois: The Goodheart-Willcox Company, Inc., 1973. (IL/3).	Book	787
	3. Use specific service and repair manual for type of tractor being serviced and repaired.		
DISASSEMBLING AND OVERHAULING THE ENGINE BLOCK AND HEAD IN FARM TRACTORS	1. Rader, Thomas, ed. Fundamentals of Service: Engines. Moline, Illinois: John Deere and Company, 1972. (IL/1).	Book, slides are also available for this document.	787

MODULE TITLES	SELECTED REFERENCES	TYPE OF MATERIALS	AGDEX NUMBERS
DISASSEMBLING AND OVERHAULING THE ENGINE BLOCK AND HEAD IN FARM TRACTORS (cont.)	2. Toboldt, William K. Diesel: Fundamentals, Service, Repair. South Holland, Illinois: The Goodheart-Willcox Company, Inc., 1973. (IL/3).	Book	787
	3. Use specific service and repair manual for type of tractor being serviced and repaired.		
SERVICING AND REPAIRING THE STEERING SYSTEM IN FARM TRACTORS	1. Borgman, Donald E., Hainline, Everette, and Long, Melvin E. Fundamentals of Machine Operation: Tractors. Moline, Illinois: John Deere and Company, 1974. (IL/1).	Book, slides are also available for this document.	762
	2. Hathaway, Louis. Fundamentals of Machine Operation: Preventive Maintenance. Moline, Illinois: John Deere and Company, 1974. (IL/1).	Book, slides are also available for this document.	787
	3. Use specific service and repair manual for type of tractor being serviced and repaired.		
SERVICING AND REPAIRING THE HYDRAULIC SYSTEM IN FARM TRACTORS	1. Rader, Thomas, ed. Fundamentals of Service: Hydraulics. Moline, Illinois: John Deere and Company, 1972. (IL/1).	Book, slides are also available for this document.	787
	2. Turner, J. Howard and Wren, James E. Hydraulic Systems for Tractors and Other Mobile Equipment Vol. I--Care and Operation. Athens, Georgia: American Association for Vocational Instructional Materials, 1974. (MI/1).	Book	787
	3. Turner, J. Howard and Wren, James E. Hydraulic Systems for Tractors and Other Mobile Equipment Vol. II--Inspection and Testing. Athens, Georgia: American Association for Vocational Instructional Materials, 1974. (MI/1).	Book	787

MODULE TITLES	SELECTED REFERENCES	TYPE OF MATERIALS	AGDEX NUMBERS
SERVICING AND REPAIRING THE HYDRAULIC SYSTEM IN FARM TRACTORS (cont.)	4. Parady, W. Harold and Turner, J. Howard. Tractor Maintenance Principles and Procedures. Athens, Georgia: American Association for Vocational Instructional Materials, 1975. (MI/1).	Book, slides are also available for this document.	787
	5. Hathaway, Louis. Fundamentals of Machine Operation: Preventive Maintenance. Moline, Illinois: John Deere and Company, 1974. (IL/1).	Book, slides are also available for this document.	787
	6. Borgman, Donald E., Hainline, Everette, and Long, Melvin E. Fundamentals of Machine Operation: Tractors. Moline, Illinois: John Deere and Company, 1974. (IL/1).	Book, slides are also available for this document.	762
	7. Prombersberger, William J., Bishop, Frank E., and Priebe, Donald W. Modern Farm Power. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1971. (NJ/1).	Book	787
	8. Use specific service and repair manual for type of tractor being serviced and repaired.		
SERVICING AND REPAIRING THE BRAKE SYSTEM IN FARM TRACTORS	1. Hathaway, Louis. Fundamentals of Machine Operation: Preventive Maintenance. Moline, Illinois: John Deere and Company, 1973. (IL/1).	Book, slides are also available for this document.	787
	2. Parady, W. Harold and Turner, J. Howard. Tractor Maintenance Principles and Procedures. Athens, Georgia: American Association for Vocational Instructional Materials, 1975. (MI/1).	Book, slides are also available for this document.	787
	3. Borgman, Donald E., Hainline, Everette, and Long, Melvin E. Fundamentals of Machine Operation: Tractors. Moline, Illinois: John Deere and Company, 1974. (IL/1).	Book, slides are also available for this document.	762

MODULE TITLES	SELECTED REFERENCES	TYPE OF MATERIALS	AGDEX NUMBERS
SERVICING AND REPAIRING THE BRAKE SYSTEM IN FARM TRACTORS (cont.)	4. Bryant, J.G., Turner, J. Howard, and Smith, George W. Farm Tractor Tune-Up and Service Specifications. Athens, Georgia: American Association for Vocational Instructional Materials, 1972. (MI/1).	Book	787
	5. Use specific service and repair manual for type of tractor being serviced and repaired.		
SERVICING AND REPAIRING THE POWER TAKE-OFF ASSEMBLY IN FARM TRACTORS	1. Borgman, Donald E., Hainline, Everette, and Long, Melvin E. Fundamentals of Machine Operation: Tractors. Moline, Illinois: John Deere and Company, 1974. (IL/1).	Book, slides are also available for this document.	762
	2. Rader, Thomas, ed. Fundamentals of Service: Power Trains. Moline, Illinois: John Deere and Company, 1972. (IL/1).	Book, slides and transparency masters are also available for this document.	787
	3. Use specific service and repair manual for type of tractor being serviced and repaired.		
SERVICING AND REPAIRING THE AIR CONDITIONING SYSTEM ON FARM TRACTORS	1. Rader, Thomas, ed. Fundamentals of Service: Air Conditioning. Moline, Illinois: John Deere and Company, 1973. (IL/1).	Book, slides are also available for this document.	787
	2. Use specific service and repair manual for type of tractor being serviced and repaired.		
SERVICING AND REPAIRING TRANSMISSIONS IN FARM TRACTORS	1. Farm and Industrial Equipment Institute. Tractor Transmissions. Athens, Georgia: American Association for Vocational Instructional Materials. (MI/1).	Book	787

MODULE TITLES	SELECTED REFERENCES	TYPE OF MATERIALS	AGDEX NUMBERS
SERVICING AND REPAIRING TRANSMISSIONS IN FARM TRACTORS (cont.)	2. Hathaway, Louis. Fundamentals of Machine Operation: Preventive Maintenance. Moline, Illinois: John Deere and Company, 1973. (IL/1).	Book, slides are also available for this document.	787
	3. Rader, Thomas, ed. Fundamentals of Service: Power Trains. Moline, Illinois: John Deere and Company, 1972. (IL/1).	Book, slides and transparency masters are also available for this document.	787
	4. Parady, W. Harold and Turner, J. Howard. Tractor Maintenance Principles and Procedures. Athens, Georgia: American Association for Vocational Instructional Materials, 1975. (MI/1).	Book, slides are also available for this document.	787
	5. Use specific service and repair manual for type of tractor being serviced and repaired.		
INSPECTING AND REPAIRING THE CRANKSHAFT AND FLYWHEEL ASSEMBLY IN FARM TRACTORS	1. Rader, Thomas, ed. Fundamentals of Service: Engines. Moline, Illinois: John Deere and Company, 1972. (IL/1).	Book, slides and transparency masters are also available for this document.	787
	2. Use specific service and repair manual for type of tractor being serviced and repaired.		
REPAIRING THE VALVE SYSTEMS IN FARM TRACTORS	1. Rader, Thomas, ed. Fundamentals of Service: Engines. Moline, Illinois: John Deere and Company, 1972. (IL/1).	Book, slides and transparency masters are also available for this document.	787

MODULE TITLES	SELECTED REFERENCES	TYPE OF MATERIALS	AGDEX NUMBERS
SERVICING AND REPAIRING TRANSMISSIONS IN FARM TRACTORS (cont.)	2. Hathaway, Louis. Fundamentals of Machine Operation: Preventive Maintenance. Moline, Illinois: John Deere and Company, 1973. (IL/1).	Book, slides are also available for this document.	787
	3. Rader, Thomas, ed. Fundamentals of Service: Power Trains. Moline, Illinois: John Deere and Company, 1972. (IL/1).	Book, slides and transparency masters are also available for this document.	787
	4. Parady, W. Harold and Turner, J. Howard. Tractor Maintenance Principles and Procedures. Athens, Georgia: American Association for Vocational Instructional Materials, 1975. (MI/1).	Book, slides are also available for this document.	787
	5. Use specific service and repair manual for type of tractor being serviced and repaired.		
INSPECTING AND REPAIRING THE CRANKSHAFT AND FLYWHEEL ASSEMBLY IN FARM TRACTORS	1. Rader, Thomas, ed. Fundamentals of Service: Engines. Moline, Illinois: John Deere and Company, 1972. (IL/1).	Book, slides and transparency masters are also available for this document.	787
	2. Use specific service and repair manual for type of tractor being serviced and repaired.		
REPAIRING THE VALVE SYSTEMS IN FARM TRACTORS	1. Rader, Thomas, ed. Fundamentals of Service: Engines. Moline, Illinois: John Deere and Company, 1972. (IL/1).	Book, slides and transparency masters are also available for this document.	787

MODULE TITLES	SELECTED REFERENCES	TYPE OF MATERIALS	AGDEX NUMBERS
REPAIRING THE VALVE SYSTEMS IN FARM TRACTORS (cont.)	2. Hathaway, Louis. Fundamentals of Machine Operation: Preventive Maintenance. Moline, Illinois: John Deere and Company, 1973. (IL/1).	Book, slides are also available for this document.	787
	3. Bryant, J.G., Turner, J. Howard, and Smith, George W. Farm Tractor Tune-Up and Service Specifications. Athens, Georgia: American Association for Vocational Instructional Materials, 1972. (MI/1).	Book	787
	4. Toboldt, William K. Diesel: Fundamentals, Service, Repair. South Holland, Illinois: The Goodheart-Willcox Company, Inc., 1973. (IL/3).	Book	787
	5. Use specific service and repair manual for type of tractor being servied and repaired.		
SERVICING AND REPAIRING THE GOVERNOR SYSTEM ON FARM TRACTORS	1. Rader, Thomas, ed. Fundamentals of Service: Engines. Moline, Illinois: John Deere and Company, 1972. (IL/1).	Book, slides and transparency masters are also available for this document.	787
	2. Parady, W. Harold and Turner, J. Howard. Tractor Maintenance Principles and Procedures. Athens, Georgia: American Association for Vocational Instructional Materials, 1975. (MI/1).	Book, slides are also available for this document.	787
	3. Toboldt, William K. Diesel: Fundamentals, Service, Repair. South Holland, Illinois: The Goodheart-Willcox Company, Inc., 1973. (IL/3).	Book	787
	4. Use specific service and repair manual for the type of tractor being serviced and repaired.		

MODULE TITLES	SELECTED REFERENCES	TYPE OF MATERIALS	AGDEX NUMBERS
SERVICING AND REPAIRING WHEELS, TIRES, AND TRACKS ON FARM TRACTORS	1. Rader, Thomas, ed. Fundamentals of Service: Tires and Tracks. Moline, Illinois: John Deere and Company, 1974. (IL/1).	Book, slides are also available for this document.	787
	2. Tires for Farm Equipment. VAS 3031. Urbana, Illinois: Vocational Agriculture Service of the University of Illinois. (IL/2).	Pamphlet	787
	3. Use specific service and repair manual for the type of tractor being serviced and repaired.		
LUBRICATING AND GREASING FARM TRACTORS	1. Rader, Thomas, ed. Fundamentals of Service: Engines. Moline, Illinois: John Deere and Company, 1972. (IL/1).	Book, slides and transparency masters are also available for this document.	787
	2. Anderson, Edwin F. Audels: Gas Engine Manual. Indianapolis, Indiana: The Bobbs-Merrill Company, Inc. 1975. (IN/1).	Book	787
	3. Hathaway, Louis. Fundamentals of Machine Operation: Preventive Maintenance. Moline, Illinois: John Deere and Company, 1973. (IL/1).	Book, slides are also available for this document.	787
	4. Borgman, Donald E., Hainline, Everette, and Long, Melvin E. Fundamentals of Machine Operation: Tractors. Moline, Illinois: John Deere and Company, 1974. (IL/1).	Book, slides are also available for this document.	762
	5. Parady, W. Harold and Turner, J. Howard. Tractor Maintenance Principles and Procedures. Athens, Georgia: American Association for Vocational Instructional Materials, 1975. (MI/1).	Book, slides are also available for this document.	787

MODULE TITLES	SELECTED REFERENCES	TYPE OF MATERIALS	AGDEX NUMBERS
LUBRICATING AND GREASING FARM TRACTORS (cont.)	6. Toboldt, William K. *Diesel: Fundamentals, Service, Repair.* South Holland, Illinois: The Goodheart-Willcox Company, Inc., 1973. (IL/3).	Book	787
	7. Use specific service and repair manual for the type of tractor being serviced and repaired.		
CLEANING AND STORING FARM TRACTORS	1. Parady, W. Harold and Turner, J. Howard. *Tractor Maintenance Principles and Procedures.* Athens, Georgia: American Association for Vocational Instructional Materials, 1975. (MI/1).	Book, slides are also available for this document.	787
	2. Borgman, Donald E., Hainline, Everette, and Long, Melvin E. *Fundamentals of Machine Operation: Tractors.* Moline, Illinois: John Deere and Company, 1974. (IL/1).	Book, slides are also available for this document.	762
	3. Hathaway, Louis. *Fundamentals of Machine Operation: Preventive Maintenance.* Moline, Illinois: John Deere and Company, 1973. (IL/1).	Book, slides are also available for this document.	787
	4. Rader, Thomas, ed. *Fundamentals of Service: Belts and Chains.* Moline, Illinois: John Deere and Company, 1974. (IL/1).	Book, slides are also available for this document.	787
ASSEMBLING, ADJUSTING, REPAIRING AND/OR SERVICING FARM TILLAGE EQUIPMENT	1. Rader, Thomas, ed. *Fundamentals of Machine Operation: Tillage.* Moline, Illinois: John Deere and Company, 1976. (IL/1).	Book, slides are also available for this document.	741
	2. *Fundamentals of Machine Operation: Agricultural Machinery Safety.* Moline, Illinois: John Deere and Company, 1974. (IL/1).	Book, slides are also available for this document.	741

MODULE TITLES	SELECTED REFERENCES	TYPE OF MATERIALS	AGDEX NUMBERS
ASSEMBLING, ADJUSTING, REPAIRING, AND/OR SERVICING FARM TILLAGE EQUIPMENT (cont.)	3. Use specific service and repair manual for the type of equipment being serviced and repaired.		
	4. Use specific set-up manual for the type of equipment being assembled.		
ASSEMBLING, ADJUSTING, REPAIRING AND/OR SERVICING FARM PLANTING EQUIPMENT	1. Breece, H. Edward, Hansen, Harold V., and Hoerner, Thomas A. Fundamentals of Machine Operation: Planting. Moline, Illinois: John Deere and Company, 1975. (IL/1).	Book, slides are also available for this document.	742
	2. The Planter--Selection, Adjustment, Maintenance, and Use. VAS 3021. Urbana, Illinois: Vocational Agriculture Service, University of Illinois. (IL/2).	Pamphlet	742
	3. Use specific service and repair manual for the type of equipment being serviced and repaired.		
	4. Use specific set-up manual for the type of equipment being assembled.		
ASSEMBLING, ADJUSTING, REPAIRING AND/OR SERVICING FARM FERTILIZER APPLICATION EQUIPMENT	1. Calibrating a Granular Applicator (#443). Urbana, Illinois: Vocational Agriculture Service, University of Illinois. (IL/2).	Filmstrip	743
	2. Use specific service and repair manual for the type of equipment being serviced and repaired.		
	3. Use specific set-up manual for the type of equipment being assembled.		

MODULE TITLES	SELECTED REFERENCES	TYPE OF MATERIALS	AGDEX NUMBERS
ASSEMBLING, ADJUSTING, REPAIRING AND/OR SERVICING OF SPRAYING AND DUSTING APPLICATION FARM EQUIPMENT	1. Rader, Thomas, ed. Fundamentals of Serivce: Mowing and Sprayer Equipment. Moline, Illinois: John Deere and Company, 1974. (IL/1).	Book, slides are also available for this document.	740
	2. Applying Pesticides. Athens, Georgia: American Association for Vocational Instructional Materials, 1976. (MI/1).	Book	606
	3. Calibrating Field Sprayers (#442). Urbana, Illinois: Vocational Agriculture Service of the University of Illinois. (IL/2).	Filmstrip	744
	4. Field Sprayer Calibration (#503). Ames, Iowa: Iowa Association for Vocational Instructional Materials at Iowa State University. (IA/1).	Transparency Masters	744
	5. Use specific service and repair manual for the type of equipment being serviced and repaired.		
	6. Use specific set-up manual for the type of equipment being assembled.		
ASSEMBLING, ADJUSTING, REPAIRING AND/OR SERVICING FARM CULTIVATION EQUIPMENT	1. Use specific service and repair manual for the type of equipment being serviced and repaired.		
	2. Use specific set-up manual for the type of equipment being assembled.		
ASSEMBLING, ADJUSTING, REPAIRING AND/OR SERVICING HARVESTING FARM EQUIPMENT	1. Turner, J. Howard, Smith, George W., and Wren, James E. Selecting and Maintaining Field Mowers. Athens, Georgia: American Association for Vocational Instructional Materials, 1966. (MI/1).	Book	787
	2. Rader, Thomas, ed. Fundamentals of Service: Mowing and Spraying Equipment. Moline, Illinois: John Deere and Company, 1974. (IL/1).	Book, slides are also available for this document.	740

MODULE TITLES	SELECTED REFERENCES	TYPE OF MATERIALS	AGDEX NUMBERS
ASSEMBLING, ADJUSTING, REPAIRING AND/OR SERVICING HARVESTING FARM EQUIPMENT (cont.)	3. Griffen, George A. Fundamentals of Machine Operation: Combine Harvesting. Moline, Illinois: John Deere and Company, 1973. (IL/1).	Book, slides are also available for this document.	740
	4. Combines and Combining. Columbus, Ohio: Department of Agricultural Education, The Ohio State University, 1970. (OH/2).	Manual	745
	5. Use specific service and repair manual for the type of equipment being serviced and repaired.		
	6. Use specific set-up manual for the type of equipment being assembled.		
PERFORMING GENERAL OFFICE DUTIES	1. Doris, Lillian and Miller, Bessey M. Complete Secretary's Handbook. Englewood Cliffs, New Jersey: Prentice-Hall, Inc. (NJ/1).	Book	900/14
	2. Office Procedures Used in the Agricultural Services. Columbus, Ohio: Ohio Agricultural Education Curriculum Materials Service, The Ohio State University. (OH/2).	Pamphlet	900/14
	3. Trotter, E.E. and Herbst, J.H. Human Relations in Agricultural Business. VAS 6003. Urbana, Illinois: Vocational Agriculture Serivce, University of Illinois. (IL/2).	Pamphlet	900/60
	4. Trotter, E.E. and Herbst, J.H. Agricultural Business Procedures. VAS 6004. Urbana, Illinois: Vocational Agriculture Serivce, University of Illinois. (IL/2).	Pamphlet	900/10

MODULE TITLES	SELECTED REFERENCES	TYPE OF MATERIALS	AGDEX NUMBERS
USING COMMUNICATION EQUIPMENT	1. Federal Communications Commission, Rules and Regulations, Vol. VI. Washington, D.C.: U.S. Government Printing Office, 1975. (DC/1).	Bulletin	900/64
	2. Federal Communications Commission, Rules and Regulations, Vol. V. Washington, D.C: U.S. Government Printing Office, 1975. (DC/1).	Bulletin	900/64
MEETING THE CUSTOMER	1. Trotter, E.E. and Herbst, J.H. Human Relations in Agricultural Business. VAS 6003. Urbana, Illinois: Vocational Agriculture Service, University of Illinois. (IL/2).	Pamphlet	900/60
	2. Selling and Salesmanship. Columbus, Ohio: Ohio Agricultural Education Curriculum Machines Service, The Ohio State University, 1971, 32 pages. (OH/2).	A student reference and workbook.	900/60
PAINTING AGRICULTURAL EQUIPMENT	1. Spray Painting. VAS 3015. Urbana, Illinois: Vocational Agriculture Serivce, University of Illinois. (IL/2).	Pamphlet	784
	2. Hogg, John W. Auto Body Repair and Refinishing. New York, New York: McGraw-Hill Book Company, 1969. (NY/2).	Book	784

APPENDIX C

Key to Sources

KEY TO SOURCES

CODE	STATE	SOURCE AND ADDRESS
AZ/1	Arizona	Department of Agriculture Education University of Arizona Tucson, Arizona 85721
CA/1	California	Vocational Education Productions California Polytechnic State University San Luis Obispo, California 93402
CA/2	California	Lane Magazine and Book Company Menlo Park, Californa 94025
CA/3	California	W.H. Freeman and Company 660 Market Street San Francisco, California 94104
CO/1	Colorado	Sheep Industry Development Program, Inc. 200 Clayton Street Denver, Colorado 80206
CO/2	Colorado	Agricultural Education Section Colorado State University 530 Peterson Street Ft. Collins, Colorado 80521
DC/1	District of Columbia	Superintendent of Documents U.S. Government Printing Office Washington, D.C. 20402
DC/2	District of Columbia	Animal Health Institute 1717 K Street, N.W. Suite 1009 Washington, D.C. 20006
IL/1	Illinois	John Deere Service Publications Department F John Deere Road Moline, Illinois 61265
IL/2	Illinois	Vocational Agriculture Service 434 Mumford Hall University of Illinois Urbana, Illinois

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IL/3	Illinois	Goodheart-Willcox Company 123 W. Taft Drive South Holland, Illinois 60473
IL/4	Illinois	American Technical Society 5608 Stoney Island Avenue Chicago, Illinois 60637
IL/5	Illinois	Chas. A. Bennett Company 809 W. Detweiller Drive Peoria, Illinois 61614
IL/6	Illinois	Farm Department National Safety Council 425 North Michigan Chicago, Illinois 60611
IL/7	Illinois	Interstate Printers and Publishers, Inc. Danville, Illinois 61832
IL/8	Illinois	Extension Bulletin Office Cooperative Extension Service University of Illinois at Urbana-Champaign Urbana, Illinois 61801
IL/9	Illinois	A&L Publications Station A, Box F Champaign, Illinois 61820
IL/10	Illinois	Stipes Publishing Company Champaign, Illinois 61820
IL/11	Illinois	National Livestock and Meat Board 36 S. Wabash Avenue Chicago, Illinois 60603
IN/1	Indiana	The Bobbs-Merrill Company, Inc. Educational Publishign Division Continuing Education & College Department 4300 W. 62nd Street Indianapolis, Indiana 46268
IN/2	Indiana	The Thompson Publishing Company Box 50160 Indianapolis, Indiana 46250

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IA/1	Iowa	IAVIM Center ATTN: Thomas A Hoerner Agriculture Engineering Department Iowa State University Ames, Iowa 50010
IA/2	Iowa	Extension Bulletin Office Cooperative Extension Service Iowa State University Ames, Iowa 50010
IA/3	Iowa	Iowa State University Press South State Avenue Ames, Iowa 50010
IA/4	Iowa	Kendall/Hunt Publishing Company 2460 Kerper Blvd. Dubuque, Iowa 52001
KY/1	Kentucky	The Public Relations and Information Department Farm Credit Banks of Louisville P.O. Box 239 Louisville, Kentucky 40201
MA/1	Maryland	Sprinkler Irrigation Association 13975 Conneticut Avenue Silver Springs, Maryland 20906
MA/2	Maryland	The Williams and Wilkins Company 428 E. Preston Street Baltimore, Maryland 21202
MI/1	Michigan	Agriculture and Natural Resources Education Institute 410 Agriculture Hall Michigan State University East Lansing, Michigan 48824
MI/2	Michigan	Michigan State University Placement Services Room 146 Student Services Building Michigan State University East Lansing, Michigan 48824
MI/3	Michigan	Extension Bulletin Office Cooperative Extension Service Michigan State University East Lansing, Michigan 48824

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MI/4	Michigan	General Motors Corporation Public Relations Department Detroit, Michigan 48202
MI/5	Michigan	4-H Bulletin Office 175 South Anthony Hall Michigan State University East Lansing, Michigan 48824
MI/6	Michigan	Training Branch U.S. Treasury Department P.O. Box 84 Detroit, Michigan 48231
MI/7	Michigan	Beverly Tallman The John Henry Company P.O. Box 1410 Lansing, Michigan 48904
MI/8	Michigan	Michigan Association of Farmer Cooperatives P.O. Box 30960 Lansing, Michigan 48909
MN/1	Minnesota	Hobar Publications 1305 Tiller Lane St. Paul, Minnesota 55112
MN/2	Minnesota	Extension Bulletin Office Cooperative Extension Service University of Minnesota St. Paul, Minnesota 35108
MO/1	Missouri	Monsanto Company 800 N. Lindberg St. Louis, Missouri 63166
MO/2	Missouri	Mr. Amon Herd, Director Instructional Materials Laboratory 10 Industrial Education Building University of Missouri--Columbia Columbia, Missouri 65201
MO/3	Missouri	Doane Agricultural Service, Inc. 8900 Manchester St. Louis, Missouri 63144
NJ/1	New Jersey	Prentice-Hall, Inc. Englewood Cliffs, New Jersey 07632

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NY/1	New York	Union Carbide Corporation Linde Division 270 Park Avenue New York, New York 10017
NY/2	New York	McGraw-Hill Book Company, Inc. 330 West 42nd Street New York, New York 10039
NY/3	New York	Brooklyn Botanic Garden 1000 Washington Avenue Brooklyn, New York 11225
NY/4	New York	Oxford University Press 200 Madison Avenue New York, New York 10016
NY/5	New York	Ronald Press 79 Madison Avenue New York, New York 10016
NY/6	New York	Cornell University Instructional Materials Service Ithaca, New York 14850
NY/7	New York	Extension Bulletin Office Cooperative Extension Service Cornell University Ithaca, New York 14850
NY/8	New York	The Macmillan Company 866 Third Avenue New York, New York 10022
NY/9	New York	Bruce Publishing Company 400 North Broadway Milwaukee, Wisconsin 53202
NY/10	New York	Agricultural Marketing Group Edison Electric Institute 90 Park Avenue New York, New York 10016
NY/11	New York	Institute of Life Insurance 277 Park Avenue New York, New York 10017

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NY/12	New York	Springer Publishing Company, Inc. 200 Park Avenue, South New York, New York 10003
NY/13	New York	John Wiley & Sons, Inc. 440 Park Avenue, South New York, New York 10016
OH/1	Ohio	James F. Lincoln Arc Welding Foundation P.O. Box 3035 Cleveland, Ohio 44117
OH/2	Ohio	Ohio Agricultural Education Curriculum Materials Service The Ohio State University Room 254, 2120 Fyffe Road Columbus, Ohio 43210
OH/3	Ohio	Extension Bulletin Office Cooperative Extension Service The Ohio State University Columbus, Ohio 43210
PA/1	Pennsylvania	Extension Bulletin Office Cooperative Extension Service Pennsylvania State University University Park, Pennsylvania 16802
PA/2	Pennsylvania	Sperry New Holland New Holland, Pennsylvania 17557
PA/3	Pennsylvania	Lea & Febiger 600 South Washington Square Philadelphia, Pennsylvania 19106
SC/1	South Carolina	Extension Bulletin Office Cooperative Extension Service Clemson University Clemson, South Carolina 29631
TX/1	Texas	Vocational Instructional Service F.E. Box 182 Texas A&M University College Station, Texas 77843
VA/1	Virginia	National Concrete Masonry Association 1800 N. Kent Arlington, Virginia 22209

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VA/2	Virginia	Extension Bulletin Office Cooperative Extension Service Virginia Polytechnic Institute and State University Blacksburg, Virginia 24061
WI/1	Wisconsin	Extension Bulletin Office Cooperative Extension Service University of Wisconsin Madison, Wisconsin 53706
WI/2	Wisconsin	National Vo-Ag Book Company Sheldon, Wisconsin 54766
WI/3	Wisconsin	The Highsmith Company, Inc. P.O. Box 150 Fort Atkinson, Wisconsin 53538
WI/4	Wisconsin	Midwest Breeders Cooperative Shawano, Wisconsin 54166